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(54) Title: ANTI-MICRORNA OLIGONUCLEOTIDE MOLECULES

(57) Abstract: The invention relates to isolated anti-microRNA molecules. In another embodiment, the invention relates to an isolated microRNA molecule. In yet another embodiment, the invention provides a method for inhibiting microRNP activity in a cell.

Anti-MicroRNA Oligonucleotide Molecules

This application is a continuing application of U.S. Application Serial Number 10/778,908 filed on February 13, 2004. The specification of U.S. Application Serial Number 10/778,908 is hereby incorporated by reference in its entirety.

The invention claimed herein was made with the help of grant number 1 R01 GM068476-01 from NIH/NIGMS. The U.S. government has certain rights in the invention.

BACKGROUND OF THE INVENTION

RNA silencing is a fundamental mechanism of gene regulation that uses double-stranded RNA (dsRNA) derived 21- to 28-nucleotide (nt) small RNAs to guide mRNA degradation, control mRNA translation or chromatin modification. Recently, several hundred novel genes were identified in plants and animals that encode transcripts that contain short dsRNA hairpins.

Defined 22-nt RNAs, referred to as microRNAs (miRNAs), are reported to be excised by dsRNA specific endonucleases from the hairpin precursors. The miRNAs are incorporated into ribonucleoprotein particles (miRNPs).

Plant miRNAs target mRNAs containing sequence segments with high complementarity for degradation or suppress translation of partially complementary mRNAs. Animal miRNAs appear to act predominantly as translational repressors. However, animal miRNAs have also been reported to guide RNA degradation. This indicates that animal miRNPs act like small interfering RNA (siRNA)-induced silencing complexes (RISCs).

Understanding the biological function of miRNAs requires knowledge of their mRNA targets. Bioinformatic approaches have been used to predict mRNA targets, among which transcription factors and proapoptotic genes were prominent candidates. Processes such as *Notch* signaling, cell proliferation, morphogenesis and axon guidance appear to be controlled by miRNA genes.

Therefore, there is a need for materials and methods that can help elucidate the function of known and future microRNAs. Due to the ability of microRNAs to induce RNA degradation

or repress translation of mRNA which encode important proteins, there is also a need for novel compositions for inhibiting microRNA-indexed cleavage or repression of mRNAs.

SUMMARY THE INVENTION

In one embodiment, the invention provides an isolated single stranded anti-microRNA molecule comprising a minimum of ten moieties and a maximum of fifty moieties on a molecular backbone, the molecular backbone comprising backbone units, each moiety comprising a base bonded to a backbone unit, each base forming a Watson-Crick base pair with a complementary base wherein at least ten contiguous bases have the same sequence as a sequence of bases in any one of the anti-microRNA molecules shown in Tables 1-4, except that up to thirty percent of the bases pairs may be wobble base pairs, and up to 10% of the contiguous bases may be additions, deletions, mismatches, or combinations thereof; no more than fifty percent of the contiguous moieties contain deoxyribonuleotide backbone units; the moiety in the molecule at the position corresponding to position 11 of the microRNA is non-complementary; and the molecule is capable of inhibiting microRNP activity.

In another embodiment, the invention provides a method for inhibiting microRNP activity in a cell, the microRNP comprising a microRNA molecule, the microRNA molecule comprising a sequences of bases complementary of the sequence of bases in a single stranded anti-microRNA molecule, the method comprising introducing into the cell the single-stranded anti-microRNA molecule comprising a sequence of a minimum of ten moieties and a maximum of fifty moieties on a molecular backbone, the molecular backbone comprising backbone units, each moiety comprising a base bonded to a backbone unit, each base forming a Watson-Crick base pair with a complementary base, wherein at least ten contiguous bases of the anti-microRNA molecule are complementary to the microRNA, except that up to thirty percent of the bases may be substituted by wobble base pairs, and up to ten percent of the at least ten moieties may be additions, deletions, mismatches, or combinations thereof; no more than fifty percent of the contiguous moieties contain deoxyribonuleotide backbone units; and the moiety in the molecule at the position corresponding to position 11 of the microRNA is non-complementary.

In another embodiment, the invention provides an isolated microRNA molecule comprising a minimum of ten moieties and a maximum of fifty moieties on a molecular

backbone, the molecular backbone comprising backbone units, each moiety comprising a base bonded to a backbone unit, wherein at least ten contiguous bases have the same sequence as a sequence of bases in any one of the microRNA molecules shown in Table 2, except that up to thirty percent of the bases pairs may be wobble base pairs, and up to 10% of the contiguous bases may be additions, deletions, mismatches, or combinations thereof; and no more than fifty percent of the contiguous moieties contain deoxyribonuleotide backbone units.

In another embodiment, the invention provides an isolated microRNA molecule comprising a minimum of ten moieties and a maximum of fifty moieties on a molecular backbone, the molecular backbone comprising backbone units, each moiety comprising a base bonded to a backbone unit, wherein at least ten contiguous bases have any one of the microRNA sequences shown in Tables 1, 3 and 4, except that up to thirty percent of the bases pairs may be wobble base pairs, and up to 10% of the contiguous bases may be additions, deletions, mismatches, or combinations thereof; no more than fifty percent of the contiguous moieties contain deoxyribonuleotide backbone units; and is modified for increased nuclease resistance.

In yet another embodiment, the invention provides an isolated single stranded antimicroRNA molecule comprising a minimum of ten moieties and a maximum of fifty moieties on a molecular backbone, the molecular backbone comprising backbone units, each moiety comprising a base bonded to a backbone unit, each base forming a Watson-Crick base pair with a complementary base wherein at least ten contiguous bases have the same sequence as a sequence of bases in any one of the anti-microRNA molecules shown in Tables 1-4, except that up to thirty percent of the bases pairs may be wobble base pairs, and up to 10% of the contiguous bases may be additions, deletions, mismatches, or combinations thereof; no more than fifty percent of the contiguous moieties contain deoxyribonuleotide backbone units; and the molecule is capable of inhibiting microRNP activity.

In yet a further embodiment, the invention provides a method for inhibiting microRNP activity in a cell, the microRNP comprising a microRNA molecule, the microRNA molecule comprising a sequences of bases complementary of the sequence of bases in a single stranded anti-microRNA molecule, the method comprising introducing into the cell the single-stranded anti-microRNA molecule comprising a sequence of a minimum of ten moieties and a maximum

of fifty moieties on a molecular backbone, the molecular backbone comprising backbone units, each moiety comprising a base bonded to a backbone unit, each base forming a Watson-Crick base pair with a complementary base, wherein at least ten contiguous bases of the antimicroRNA molecule are complementary to the microRNA, except that up to thirty percent of the bases may be substituted by wobble base pairs, and up to ten percent of the at least ten moieties may be additions, deletions, mismatches, or combinations thereof; and no more than fifty percent of the contiguous moieties contain deoxyribonuleotide backbone units.

DESCRIPTION OF THE FIGURES

Figure 1 shows the modified nucleotide units discussed in the specification. B denotes any one of the following nucleic acid bases: adenosine, cytidine, guanosine, thymine, or uridine.

Figure 2. Antisense 2'-O-methyl oligoribonucleotide specifically inhibit miR-21 guided cleavage activity in HeLa cell S100 cytoplasmic extracts. The black bar to the left of the RNase T1 ladder represents the region of the target RNA complementary to miR-21. Oligonucleotides complementary to miR-21 were pre-incubated in S100 extracts prior to the addition of ³²P-cap-labelled cleavage substrate. Cleavage bands and T1 hydrolysis bands appear as doublets after a 1-nt slipping of the T7 RNA polymerase near the middle of the transcript indicated by the asterisk.

Figure 3. Antisense 2'-O-methyl oligoribonucleotides interfere with endogenous miR-21 RNP cleavage in HeLa cells. HeLa cells were transfected with pHcRed and pEGFP or its derivatives, with or without inhibitory or control oligonucleotides. EGFP and HcRed protein fluorescence were excited and recorded individually by fluorescence microscopy 24 h after transfection. Co-expression of co-transfected reporter plasmids was documented by superimposing of the fluorescence images in the right panel.

DETAILED DESCRIPTION OF THE INVENTION

The invention relates to an isolated single stranded anti-microRNA molecule. The molecule comprises a minimum number of ten moieties, preferably a minimum of thirteen, more preferably a minimum of fifteen, even more preferably a minimum of 18, and most preferably a minimum of 21 moieties.

The anti-microRNA molecule comprises a maximum number of fifty moieties, preferably a maximum of forty, more preferably a maximum of thirty, even more preferably a maximum of twenty-five, and most preferably a maximum of twenty-three moieties. A suitable range of minimum and maximum number of moieties may be obtained by combining any of the above minima with any of the above maxima.

Each moiety comprises a base bonded to a backbone unit. In this specification, a base refers to any one of the nucleic acid bases present in DNA or RNA. The base can be a purine or pyrimidine. Examples of purine bases include adenine (A) and guanine (G). Examples of pyrimidine bases include thymine (T), cytosine (C) and uracil (U). Each base of the moiety forms a Watson-Crick base pair with a complementary base.

Watson-Crick base pairs as used herein refers to the hydrogen bonding interaction between, for example, the following bases: adenine and thymine (A = T); adenine and uracil (A = U); and cytosine and guanine (C = G). The adenine can be replaced with 2,6-diaminopurine without compromising base-pairing.

The backbone unit may be any molecular unit that is able stably to bind to a base and to form an oligomeric chain. Suitable backbone units are well known to those in the art.

For example, suitable backbone units include sugar-phosphate groups, such as the sugar-phosphate groups present in ribonucleotides, deoxyribonucleotides, phosphorothioate deoxyribose groups, N'3-N'5 phosphoroamidate deoxyribose groups, 2'O-alkyl-ribose phosphate groups, 2'-O-alkyl-alkoxy ribose phosphate groups, ribose phosphate group containing a methylene bridge, 2'-Fluororibose phosphate groups, morpholino phosphoroamidate groups, cyclohexene groups, tricyclo phosphate groups, and amino acid molecules.

In one embodiment, the anti-microRNA molecule comprises at least one moiety which is a ribonucleotide moiety or a deoxyribonucleotide moiety.

In another embodiment, the anti-microRNA molecule comprises at least one moiety which confers increased nuclease resistance. The nuclease can be an exonuclease, an endonuclease, or both. The exonuclease can be a 3'-5' exonuclease or a 5'-3' exonuclease. Examples of 3'-5' human exonuclease include PNPT1, Werner syndrome helicase, RRP40,

RRP41, RRP42, RRP45, and RRP46. Examples of 5'→3' exonuclease include XRN2, and FEN1. Examples of endonucleases include Dicer, Drosha, RNase4, Ribonuclease P, Ribonuclease H1, DHP1, ERCC-1 and OGG1. Examples of nucleases which function as both an exonuclease and an endonuclease include APE1 and EXO1.

An anti-microRNA molecule comprising at least one moiety which confers increased nuclease resistance means a sequence of moieties wherein at least one moiety is not recognized by a nuclease. Therefore, the nuclease resistance of the molecule is increased compared to a sequence containing only unmodified ribonucleotide, unmodified deoxyribonucleotide or both. Such modified moieties are well known in the art, and were reviewed, for example, by Kurreck, Eur. J. Biochem. 270, 1628-1644 (2003).

A modified moiety can occur at any position in the anti-microRNA molecule. For example, to protect the anti-microRNA molecule against 3' \rightarrow 5' exonucleases, the molecule can have at least one modified moiety at the 3' end of the molecule and preferably at least two modified moieties at the 3' end. If it is desirable to protect the molecule against 5' \rightarrow 3' exonuclease, the anti-microRNA molecule can have at least one modified moiety and preferably at least two modified moieties at the 5' end of the molecule. The anti-microRNA molecule can also have at least one and preferably at least two modified moieties between the 5' and 3' end of the molecule to increase resistance of the molecule to endonucleases. In one embodiment, all of the moieties are nuclease resistant.

In another embodiment, the anti-microRNA molecule comprises at least one modified deoxyribonucleotide moiety. Suitable modified deoxyribonucleotide moieties are known in the art.

A suitable example of a modified deoxyribonucleotide moiety is a phosphorothioate deoxyribonucleotide moiety. See structure 1 in figure 1. An anti-microRNA molecule comprising more than one phosphorothioate deoxyribonucleotide moiety is referred to as phosphorothioate (PS) DNA. See, for example, Eckstein, Antisense Nucleic Acids Drug Dev. 10, 117-121 (2000).

Another suitable example of a modified deoxyribonucleotide moiety is an N'3-N'5 phosphoroamidate deoxyribonucleotide moiety. See structure 2 in figure 1. An oligonucleotide molecule comprising more than one phosphoroamidate deoxyribonucleotide moiety is referred to as phosphoroamidate (NP) DNA. See, for example, Gryaznov *et al.*, J. Am. Chem. Soc. *116*, 3143-3144 (1994).

In another embodiment, the molecule comprises at least one modified ribonucleotide moiety. Suitable modified ribonucleotide moieties are known in the art.

A suitable example of a modified ribonucleotide moiety is a ribonucleotide moiety that is substituted at the 2' position. The substituents at the 2' position may, for example, be a C_1 to C_4 alkyl group. The C_1 to C_4 alkyl group may be saturated or unsaturated, and unbranched or branched. Some examples of C_1 to C_4 alkyl groups include ethyl, isopropyl, and allyl. The preferred C_1 to C_4 alkyl group is methyl. See structure 3 in figure 1. An oligoribonucleotide molecule comprising more than one ribonucleotide moeity that is substituted at the 2' position with a C_1 to C_4 alkyl group is referred to as a 2'-O -(C_1 - C_4 alkyl) RNA, e.g.,2'-O-methyl RNA (OMe RNA).

Another suitable example of a substituent at the 2' position of a modified ribonucleotide moiety is a C_1 to C_4 alkoxy - C_1 to C_4 alkyl group. The C_1 to C_4 alkoxy (alkyloxy) and C_1 to C_4 alkyl group may comprise any of the alkyl groups described above. The preferred C_1 to C_4 alkoxy - C_1 to C_4 alkyl group is methoxyethyl. See structure 4 in figure 1. An oligonucleotide molecule comprising more than one ribonucleotide moiety that is substituted at the 2' position with a C_4 alkoxy- C_1 to C_4 alkyl group is referred to as a 2'-O-(C_1 to C_4 alkoxy - C_1 to C_4 alkyl) RNA, e.g., 2'-O-methoxyethyl RNA (MOE RNA).

Another suitable example of a modified ribonucleotide moiety is a ribonucleotide that has a methylene bridge between the 2'-oxygen atom and the 4'-carbon atom. See structure 5 in figure 1. An oligoribonucleotide molecule comprising more than one ribonucleotide moiety that has a methylene bridge between the 2'-oxygen atom and the 4'-carbon atom is referred to as locked nucleic acid (LNA). See, for example, Kurreck *et al.*, Nucleic Acids Res. *30*, 1911-1918 (2002); Elayadi *et al.*, Curr. Opinion Invest. Drugs *2*, 558-561 (2001); Ørum *et al.*, Curr. Opinion Mol. Ther. *3*, 239-243 (2001); Koshkin *et al.*, Tetrahedron *54*, 3607-3630 (1998); Obika *et al.*,

Tetrahedron Lett.39, 5401-5404 (1998). Locked nucleic acids are commercially available from Proligo (Paris, France and Boulder, Colorado, USA).

Another suitable example of a modified ribonucleotide moiety is a ribonucleotide that is substituted at the 2' position with fluoro group. A modified ribonucleotide moiety having a fluoro group at the 2' position is a 2'-fluororibonucleotide moiety. Such moieties are known in the art. Molecules comprising more than one 2'-fluororibonucleotide moiety are referred to herein as 2'-fluororibo nucleic acids (FANA). See structure 7 in figure 1. Damha *et al.*, J. Am. Chem. Soc. *120*, 12976-12977 (1998).

In another embodiment, the anti-microRNA molecule comprises at least one base bonded to an amino acid residue. Moieties that have at least one base bonded to an amino acid residue will be referred to herein as peptide nucleic acid (PNA) moieties. Such moieties are nuclease resistance, and are known in the art. Molecules having more than one PNA moiety are referred to as peptide nucleic acids. See structure 6 in figure 1. Nielson, Methods Enzymol. 313, 156-164 (1999); Elayadi, et al, id.; Braasch et al., Biochemistry 41, 4503-4509 (2002), Nielsen et al., Science 254, 1497-1500 (1991).

The amino acids can be any amino acid, including natural or non-natural amino acids. Naturally occurring amino acids include, for example, the twenty most common amino acids normally found in proteins, i.e., alanine (Ala), arginine (Arg), asparagine (Asn), aspartic acid (Asp), cysteine (Cys), glutamine (Glu), glutamic acid (Glu), glycine (Gly), histidine (His), isoleucine (Ileu), leucine (Leu), lysine (Lys), methionine (Met), phenylalanine (Phe), proline (Pro), serine (Ser), threonine (Thr), tryptophan, (Trp), tyrosine (Tyr), and valine (Val).

The non-natural amino acids may, for example, comprise alkyl, aryl, or alkylaryl groups. Some examples of alkyl amino acids include α -aminobutyric acid, β -aminobutyric acid, γ -aminobutyric acid, δ -aminovaleric acid, and ϵ -aminocaproic acid. Some examples of aryl amino acids include ortho-, meta, and para-aminobenzoic acid. Some examples of alkylaryl amino acids include ortho-, meta-, and para-aminophenylacetic acid, and γ -phenyl- β -aminobutyric acid.

Non-naturally occurring amino acids also include derivatives of naturally occurring amino acids. The derivative of a naturally occurring amino acid may, for example, include the addition or one or more chemical groups to the naturally occurring amino acid.

For example, one or more chemical groups can be added to one or more of the 2', 3', 4', 5', or 6' position of the aromatic ring of a phenylalanine or tyrosine residue, or the 4', 5', 6', or 7' position of the benzo ring of a tryptophan residue. The group can be any chemical group that can be added to an aromatic ring. Some examples of such groups include hydroxyl, C₁-C₄ alkoxy, amino, methylamino, dimethylamino, nitro, halo (i.e., fluoro, chloro, bromo, or iodo), or branched or unbranched C₁-C₄ alkyl, such as methyl, ethyl, n-propyl, isopropyl, butyl, isobutyl, or t-butyl.

Furthermore, other examples of non-naturally occurring amino acids which are derivatives of naturally occurring amino acids include norvaline (Nva), norleucine (Nle), and hydroxyproline (Hyp).

The amino acids can be identical or different from one another. Bases are attached to the amino acid unit by molecular linkages. Examples of linkages are methylene carbonyl, ethylene carbonyl and ethyl linkages. (Nielsen et al., *Peptide Nucleic Acids-Protocols and Applications*, Horizon Scientific Press, pages 1-19; Nielsen et al., *Science* 254: 1497-1500.)

One example of a PNA moiety is N-(2-aminoethyl)-glycine. Further examples of PNA moieties include cyclohexyl PNA, retro-inverso, phosphone, propionyl and aminoproline PNA.

PNA can be chemically synthesized by methods known in the art, e.g. by modified Fmoc or tBoc peptide synthesis protocols. The PNA has many desirable properties, including high melting temperatures (Tm), high base-pairing specificity with nucleic acid and an uncharged molecular backbone. Additionally, the PNA does not confer RNase H sensitivity on the target RNA, and generally has good metabolic stability.

Peptide nucleic acids are also commercially available from Applied Biosystems (Foster City, California, USA).

In another embodiment, the anti-microRNA molecule comprises at least one morpholino phosphoroamidate nucleotide moiety. A morpholino phosphoroamidate nucleotide moiety is a modified moiety which is nuclease resistant. Such moieties are known in the art. Molecules comprising more than one morpholino phosphoroamidate nucleotide moiety are referred to as morpholino (MF) nucleic acids. See structure 8 in figure 1. Heasman, Dev. Biol. 243, 209-214 (2002). Morpholono oligonucleotides are commercially available from Gene Tools LLC (Corvallis, Oregon, USA).

In another embodiment, the anti-microRNA molecule comprises at least one cyclohexene nucleotide moiety. A cyclohexene nucleotide moiety is a modified moiety which is nuclease resistant. Such moieties are known in the art. Molecules comprising more than one cyclohexene nucleotide moiety are referred to as cyclohexene nucleic acids (CeNA). See structure 10 in figure 1. Wang *et al.*, J. Am. Chem. Soc. *122*, 8595-8602 (2000), Verbeure *et al.*, Nucleic Acids Res. *29*, 4941-4947 (2001).

In another embodiment, the anti-microRNA molecule comprises at least one tricyclo nucleotide moiety. A tricyclo nucleotide moiety is a modified moiety which is nuclease resistant. Such moieties are known in the art. Steffens *et al.*, J. Am. Chem. Soc. *119*, 11548-11549 (1997), Renneberg *et al.*, J. Am. Chem. Soc. *124*, 5993-6002 (2002). Molecules comprising more than one tricyclo nucleotide moiety are referred to as tricyclo nucleic acids (tcDNA). See structure 9 in figure 1.

In another embodiment, to increase nuclease resistance of the anti-microRNA molecules of the present invention to exonucleases, inverted nucleotide caps can be attached to the 5' end, the 3' end, or both ends of the molecule. An inverted nucleotide cap refers to a 3' \rightarrow 5' sequence of nucleic acids attached to the anti-microRNA molecule at the 5' and/or the 3' end. There is no limit to the maximum number of nucleotides in the inverted cap just as long as it does not interfere with binding of the anti-microRNA molecule to its target microRNA. Any nucleotide can be used in the inverted nucleotide cap. Typically, the inverted nucleotide cap is one nucleotide in length. The nucleotide for the inverted cap is generally thymine, but can be any nucleotide such as adenine, guanine, uracil, or cytosine.

Alternatively, an ethylene glycol compound and/or amino linkers can be attached to the either or both ends of the anti-microRNA molecule. Amino linkers can also be used to increase nuclease resistance of the anti-microRNA molecules to endonucleases. The table below lists some examples of amino linkers. The below listed amino linker are commercially available from TriLink Biotechnologies, San Diego, CA.

2'-Deoxycytidine-5-C6 Amino Linker (3' Terminus)
2'-Deoxycytidine-5-C6 Amino Linker (5' or Internal)
3' C3 Amino Linker
3' C6 Amino Linker
3' C7 Amino Linker
5' C12 Amino Linker
5' C3 Amino Linker
5' C6 Amino Linker
C7 Internal Amino Linker
Thymidine-5-C2 Amino Linker (5' or Internal)
Thymidine-5-C6 Amino Linker (3' Terminus)
Thymidine-5-C6 Amino Linker (Internal)

Chimeric anti-microRNA molecules containing a mixture of any of the moieties mentioned above are also known, and may be made by methods known, in the art. See, for example, references cited above, and Wang *et al.*, Proc. Natl. Acad. Sci. USA *96*, 13989-13994 (1999), Liang *et al.*, Eur. J. Biochem. *269*, 5753-5758 (2002), Lok *et al.*, Biochemistry *41*, 3457-3467 (2002), and Damha *et al.*, J. Am. Chem. Soc. *120*, 12976-12977 (2002).

The molecules of the invention comprise at least ten contiguous, preferably at least thirteen contiguous, more preferably at least fifteen contiguous, and even more preferably at least twenty contiguous bases that have the same sequence as a sequence of bases in any one of the anti-microRNA molecules shown in Tables 1-4. The anti-microRNA molecules optimally

comprise the entire sequence of any one of the anti-microRNA molecule sequences shown in Tables 1-4.

For the contiguous bases mentioned above, up to thirty percent of the base pairs may be substituted by wobble base pairs. As used herein, wobble base pairs refers to either: i) substitution of a cytosine with a uracil, or 2) the substitution of a adenine with a guanine, in the sequence of the anti-microRNA molecule. These wobble base pairs are generally referred to as UG or GU wobbles. Below is a table showing the number of contiguous bases and the maximum number of wobble base pairs in the anti-microRNA molecule:

Table for Number of Wobble Bases

No. of Contiguous Bases	10	11	12	13	14	15	16	17	18
Max. No. of Wobble Base Pairs	3	3	3	3	4	4	4	5	5

No. of Contiguous Bases	19	20	21	22	23
Max. No. of	5	6	6	6	6
Wobble Base					
Pairs	-				

Further, up to ten percent, and preferably up to five percent of the contiguous bases can be additions, deletions, mismatches or combinations thereof. Additions refer to the insertion in the contiguous sequence of any moiety described above comprising any one of the bases described above. Deletions refer to the removal of any moiety present in the contiguous sequence. Mismatches refer to the substitution of one of the moieties comprising a base in the contiguous sequence with any of the above described moieties comprising a different base.

The additions, deletions or mismatches can occur anywhere in the contiguous sequence, for example, at either end of the contiguous sequence or within the contiguous sequence of the anti-microRNA molecule. If the contiguous sequence is relatively short, such as from about ten

to about 15 moieties in length, preferably the additions, deletions or mismatches occur at the end of the contiguous sequence. If the contiguous sequence is relatively long, such as a minimum of sixteen contiguous sequences, then the additions, deletions, or mismatches can occur anywhere in the contiguous sequence. Below is a table showing the number of contiguous bases and the maximum number of additions, deletions, mismatches or combinations thereof:

Table for Up to 10%

No. of Contiguous Bases	10	11 .	12	13	14	15	16	17	18
Max. No. of Additions, Deletions and/or Mismatches	1	1		1	1	1	1	1	1

No. of	19	20	21	22	23
Contiguous Bases					
Max. No. of	1	2	2	2	2
Additions,					
Deletions and/or					
Mismatches					

Table for Up to 5%

No. of Contiguous Bases	10	11	12	13	· 14	15	16	17	18
Max. No. of Additions, Deletions and/or Mismatches	0	0	0	О	0	О	0	0	0

No. of Contiguous Bases	. 19	20	21	22	23
Max. No. of Additions,	0	1	1	1	1
Deletions and/or Mismatches					-

Furthermore, no more than fifty percent, and preferably no more than thirty percent, of the contiguous moieties contain deoxyribonucleotide backbone units. Below is a table showing the number of contiguous bases and the maximum number of deoxyribonucleotide backbone units:

Table for Fifty Percent Deoxyribonucleotide Backbone Units

No. of	10	11	12	13	14	15	16	17	18
Contiguous Bases								The second	
Max. No. of	5	5	6	6	7	7	8	8	9
Deoxyribonucleotide									
Backbone Units			·						`

No. of Contiguous Bases	19	20	21	22	23
Max. No. of	9	10	10	11	11
Deoxyribonucleotide					
Backbone Units					

Table for Thirty Percent Deoxyribonucleotide Backbone Units

No. of Contiguous Bases	10	11	12	13	14	15	16	17	18
Max. No. of	3	3	3	3	4	4	4	5	5
Deoxyribonucleotide									
Backbone Units									

No. of Contiguous Bases	19	20	21	22	23
Max. No. of	5	6	6	6	6
Deoxyribonucleotide					
Backbone Units					

The moiety in the anti-RNA molecule at the position corresponding to position 11 of the microRNA is optionally non-complementary to a microRNA. The moiety in the anti-microRNA molecule corresponding to position 11 of the microRNA can be rendered non-complementary by an addition, deletion or mismatch as described above.

In another embodiment, if the anti-microRNA molecule comprises only unmodified moieties, then the anti-microRNA molecules comprises at least one base, in the at least ten contiguous bases, which is non-complementary to the microRNA and/or comprises an inverted nucleotide cap, ethylene glycol compound or an amino linker.

In yet another embodiment, if the at least ten contiguous bases in an anti-microRNA molecule is perfectly (i.e., 100%) complementary to ten contiguous bases in a microRNA, then the anti-microRNA molecule contains at least one modified moiety in the at least ten contiguous bases and/or comprises an inverted nucleotide cap, ethylene glycol compound or an amino linker.

As stated above, the maximum length of the anti-microRNA molecule is 50 moieties. Any number of moieties having any base sequence can be added to the contiguous base sequence. The additional moieties can be added to the 5' end, the 3' end, or to both ends of the contiguous sequence.

MicroRNA molecules are derived from genomic loci and are produced from specific microRNA genes. Mature microRNA molecules are processed from precursor transcripts that form local hairpin structures. The hairpin structures are typically cleaved by an enzyme known as Dicer, which generates one microRNA duplex. See Bartel, Cell 116, 281-297 (2004) for a review on microRNA molecules. The article by Bartel is hereby incorporated by reference.

Each strand of a microRNA is packaged in a microRNA ribonucleoprotein complex (microRNP). A microRNP in, for example, humans, also includes the proteins eIF2C2, the helicase Gemin3, and Gemin 4.

The sequence of bases in the anti-microRNA molecules of the present invention can be derived from a microRNA from any species e.g. such as a fly (e.g., *Drosophila melanogaster*), a worm (e.g., *C. elegans*). Preferably the sequence of bases is found in mammals, especially humans (*H. sapiens*), mice (e.g., *M. musculus*), and rats (*R. norvegicus*).

The anti-microRNA molecule is preferably isolated, which means that it is essentially free of other nucleic acids. Essentially free from other nucleic acids means that it is at least 90%, preferably at least 95% and, more preferably, at least 98% free of other nucleic acids.

Preferably, the molecule is essentially pure, which means that the molecules is free not only of other nucleic acids, but also of other materials used in the synthesis of the molecule, such as, for example, enzymes used in the synthesis of the molecule. The molecule is at least 90% free, preferably at least 95% free and, more preferably, at least 98% free of such materials.

The anti-microRNA molecules of the present invention are capable of inhibiting microRNP activity, preferable in a cell. Inhibiting microRNP activity refers to the inhibition of cleavage of the microRNA's target sequence or the repression of translation of the microRNA's target sequence. The method comprises introducing into the cell a single-stranded microRNA molecule.

Any anti-microRNA molecule can be used in the methods of the present invention, as long as the anti-microRNA is complementary, subject to the restrictions described above, to the microRNA present in the microRNP. Such anti-microRNAs include, for example, the anti-

microRNA molecules mentioned above (see Table 1-4), and the anti-microRNAs molecules described in international PCT application number WO 03/029459 A2, the sequences of which are incorporated herein by reference.

The invention also includes any one of the microRNA molecules having the sequences as shown in Table 2. The novel microRNA molecules in Table 2 may optionally be modified as described above for anti-microRNA molecules. The other microRNA molecules in Tables 1, 3 and 4 are modified for increased nuclease resistance as described above for anti-microRNA molecules.

Utility

The anti-microRNA molecules and the microRNA molecules of the present invention have numerous *in vivo*, *in vitro*, and *ex vivo* applications.

For example, the anti-microRNA molecules and microRNA of the present invention may be used as a modulator of the expression of genes which are at least partially complementary to the anti-microRNA molecules and microRNA. For example, if a particular microRNA is beneficial for the survival of a cell, an appropriate isolated microRNA of the present invention may be introduced into the cell to promote survival. Alternatively, if a particular microRNA is harmful (e.g., induces apoptosis, induces cancer, etc.), an appropriate anti-microRNA molecule can be introduced into the cell in order to inhibit the activity of the microRNA and reduce the harm.

In addition, anti-microRNA molecules and/or microRNAs of the present invention can be introduced into a cell to study the function of the microRNA. Any of the anti-microRNA molecules and/or microRNAs listed above can be introduced into a cell for studying their function. For example, a microRNA in a cell can be inhibited with a suitable anti-microRNA molecule. The function of the microRNA can be inferred by observing changes associated with inhibition of the microRNA in the cell in order to inhibit the activity of the microRNA and reduce the harm.

The cell can be any cell which expresses microRNA molecules, including the microRNA molecules listed herein. Alternatively, the cell can be any cell transfected with an expression vector containing the nucleotide sequence of a microRNA.

Examples of cells include, but are not limited to, endothelial cells, epithelial cells, leukocytes (e.g., T cells, B cells, neutrophils, macrophages, eosinophils, basophils, dendritic cells, natural killer cells and monocytes), stem cells, hemopoietic cells, embryonic cells, cancer cells.

The anti-microRNA molecules or microRNAs can be introduced into a cell by any method known to those skilled in the art. Useful delivery systems, include for example, liposomes and charged lipids. Liposomes typically encapsulate oligonucleotide molecules within their aqueous center. Charged lipids generally form lipid- oligonucleotide molecule complexes as a result of opposing charges.

These liposomes-oligonucleotide molecule complexes or lipid- oligonucleotide molecule complexes are usually internalized by endocytosis. The liposomes or charged lipids generally comprise helper lipids which disrupt the endosomal membrane and release the oligonucleotide molecules.

Other methods for introducing an anti-microRNA molecule or a microRNA into a cell include use of delivery vehicles, such as dendrimers, biodegradable polymers, polymers of amino acids, polymers of sugars, and Oligonucleotide-binding nanoparticles. In addition, pluoronic gel as a depot reservoir can be used to deliver the anti-microRNA oligonucleotide molecules over a prolonged period. The above methods are described in, for example, Hughes et al., Drug Discovery Today 6, 303-315 (2001); Liang et al. Eur. J. Biochem. 269 5753-5758 (2002); and Becker et al., In Antisense Technology in the Central Nervous System (Leslie, R.A., Hunter, A.J. & Robertson, H.A., eds), pp.147-157, Oxford University Press.

Targeting of an anti-microRNA molecule or a microRNA to a particular cell can be performed by any method known to those skilled in the art. For example, the anti-microRNA molecule or microRNA can be conjugated to an antibody or ligand specifically recognized by receptors on the cell.

The sequences of microRNA and anti-microRNA molecules are shown in Tables 1-4 below. Human sequences are indicated with the prefix "hsa." Mouse sequences are indicated with the prefix "rno." *C. elegan* sequences are indicated with the prefix "cel." Drosophila sequences are indicated with the prefix "dme."

Table 1: Human, Mouse and Rat microRNA and anti-microRNA sequences.

microRNA name microRNA sequence (5' to 3') AACCCGUAGAUCCGAACUUGUG hsa-miR-103 AGCAGCAUUGUACAGGGCUAUG hsa-miR-106a AAAAGUGCUUACAGUGCAGAUAU hsa-miR-106b UAAAGUGCUGACAGGGCUAUG hsa-miR-107 AGCAGCAUUGUACAGGGCUAUC hsa-miR-108 UACCCUGUAGAACCGAAUUUGU ASA-MIR-109 CACAAGUUCGGAUCUGAGACUCUGUG CCACAGGAGUUUGAGACAUUUGU UACCUGCACUGUAAGCACUUUU GAUAGCCCUGUAAGACCUGUUA UAUCUGCACUGUAAGACCUUUU GAUAGCCCUGUACAAUGCUGCU ACAAAUUCGGUUCUACAGGGUA hsa-miR-128b UCACAGGGAACCGGUCUCUUUC ACAAAUUCGGUUCUACAGGGUA hsa-miR-140-3p LACCACAGGGUAGAACCACGAA UACCCCUUUCAUCAUCAUGACACUG ACAAAUUCGGUUCUACCCUGUGA AUGCCCUUUCAUCAUCAUGUGA AUGCCCUUUCAUCAUCAUGUGA AUGCCCUUUCAUCAUCAUGUGA AUGCCCUUUCAUCAUUGACCUG GAAAGAGACCCGGUUCACCUGUGA AUGCCCUUUCAUCAUUGCACUG AUGCCCUUUCAUCAUUUAUGCGGUAAGAACACACGGA UCCGUGGUUCUACCCUGUGGGA AUGCCCUUUCACCAUUUAA CCCGACAGGGUAGAACCACGGA UCCGUGGUUCUACCCUGGA AUGCCCUUUCACCGUUGAGA CCCCUAUCACGAUUAGACCUCGA CCCCUAUCACGAUUAAAGUAGAAUGGUU ACCACCGACAGCGUUGAAUGUU ACCACCGACAGCGUUGAAUGUU CCCCUAUCACGAUUAGAA CCCCUAUCACGAUUAGAACGAUUAAA CAAUUCAACGCUGUCGGUGAG CCCCCUAUCACGAUUAGAAUGUU ACCCCGACAGCGUUGAAUGUU CCCCCACCGACAGCAUUAGAA CCCCCACCGACAGCAUUGAAUGUU ACCCCGACAGCGUUGAAUGUU ACCCCGACAGCGUUGAACCUCGA CCCCUAUCACCGACAGCAUUAAAGUAGACACCUGGU ACCCCGACAGCAUUAAAGUUGUU ACCUGCACCGACAGCAUUACACGCUUGCGU ACCCGACAGCAUUCACCCUGUGGG ACCCCCACCGACAGCAUUAGAACCGCUGUGGG ACCCCCACCGACAGCAUUAGAACCGUUGUGAGUUUCAACCGUUGGU ACCCCGACAGCAUUAAAGUGUGUUCACCUUGCGA AUGCCCUUUCACCCUGUGGGA ACCAUCACCGACAGCAUUAAAGUGUGUUCACCUUGGA ACCUCCCCACCGACAGCAUUAAAGUGUU ACCUGCACCGACAGCAUUAAAGUGUUCAACCCUGGUGGG ACCCCCACCGACAGCAUUAAAGUGUUCAACCCUGGUGGG ACCCCCACCGACAGCAUUAAAGUGUUCAACCCUGGUGGG ACCCCCACCGACAGCAUUAAAGUGUUCAACCCUGGUGGG ACCCCCACCGACAGCAUUAAAGUGUUCAACCCUGGUGGG ACCCCCACCGACAGCAUUAAAAGUGUGUUCACCCUGGGGGA ACCCCCACCGACAGCAUUAAAAGUGUGUUCACCCUGGGGGA ACCAUCACCGACAGCAUUAAACCGCUGGUGGGGACCGGUUCAACCGGUUCAACCGGUUCAACCGGUUCAACCGGUUCAACCGAUGAACCACGAGAAUGAAU
hsa-miR-100 hsa-miR-103 hsa-miR-103 hsa-miR-103 hsa-miR-105-5p UCAAAUGCUCAGACUCUGUGG hsa-miR-106a hsa-miR-106b UAAAGUGCUUACAGUGCAGGUAU hsa-miR-107 hsa-miR-10b UACCUGUACAGUGCAGGUAU hsa-miR-10b UACCUGUAGAACCGAAUUUGU hsa-miR-10b UACCUGUAGAACCGAAUUUGU hsa-miR-128b UCACAGGGGUCUCUUUC hsa-miR-128b UCACAGGGGUCUCUUUC hsa-miR-130b CAGUGCAAUGAACCGGAUUUUC hsa-miR-140-3p UACCACAGGGUAGAACCACGGA hsa-miR-142-5p CCCAUAAAGUAGAAAGCACUAC hsa-miR-155 UUAAUGCUAACGCUGUAGAA hsa-miR-155 UUAAUGCUAAUGGUGAGAC hsa-miR-181a AACAUUCAAUGCUGGGGG CACAAGUUCACAGGGUU CACAAGGGUUAAAGCACUUUU CACAAAUUCGGUUCAAAUGUUCAACAGGGUA AAAAAUUCGGUUCAACACGUAA AAAAAUUCGGUUCAACACUGUA AUGCCCUUUCAUCAUUACACUGGA AUGCCCUUUCAUCAUUACACUGGUA AUGCCCUUUCAUCAUUACACUGGUA AUGCCCUUUCAUCAUUUAUCGG CCCCUAUCACCGUUUCACCUCUCGA CCCCUAUCACGAUUAA CCCCCUAUCACGAUUAA CCCCCCCACCGACAGCGUUGAAUGUU CCCCCCCCCC
hsa-miR-103 hsa-miR-105-5p UCAAAUGCUCAGACUCCUGUGG CCACAGGAGUCUGAGCAUUUGA hsa-miR-106a hsa-miR-106b UAAAGUGCUGACAGUGCAGAUA hsa-miR-107 hsa-miR-10b UACCCUGUAGAACCGAAUUUGU hsa-miR-128b UCACAGGGACUCUUUC hsa-miR-130b CAUAGCCCUGUAGACCUUUA AGCAGCAUUGUACAGUGCAGAUA UAUCUGCACUGUCAGCACUUUA GAUAGCCCUGUAAGCACUUUU GAUAGCCCUGUAAGCACUUUU ACCUGCACUGUAAGCACUUUU ACCAGGGCAAUUUGU ACCAAAUUCGGUUCUACAGGGUA ACAAAUUCGGUUCUACAGGGUA ACAAAUUCGGUUCACCAGGGUA AUGCCCUUUCAUCACUGUGA AUGCCCUUUCACCAGGGUA AUGCCCUUUCACCAGGGUA AUGCCCUUUCAUCACUGUGA AUGCCCUUUCACCCUGUGA AUGCCCUGUACAAUGCUGA ACAAAUUCGGUUCUACCCUGUGA AUGCCCUUUCAUCAUUGCACUG UCCGUGGUUCUACCCUGUGGUA AUGCCCUUUCACCCUGUGGUA AUGCCCUUUCACCCUUUCACCCUUCGA AUGCCCUUUCACCCUGUGGUA AUGCCCUUUCACCCUGUGGUA AUGCCCUUUCACCCUGUGGUA AUGCCCUUUCACCCUGUGGUA AUGCCCUUUCACCCUGUGGUA AUGCCCUUUCACCCUGUGGUA AUGCCCCUUUCACCCUGUGGUA AUGCCCUUUCACCCUGUGGUA AUGCCCCUGUGGUA AUGCCCUGUCACCGGUUGAAUGAU ACUAGACCGCUUUCUACCCUGUGGA ACAAAUUCCACCCUGUGGGA AUGCCCUUUCACCCUGUGGGA ACCAAAUUCCACGGUUCACCGGUA AUGCCCUUUCACCCUGUGGA AUGCCCUUUCACCCUGUGGGA AUGCCCUUUCACCCUGUGGGA AUGCCCUUUCACCCUGUGGGA AUGCCCUUUCACCCUGUGGGA AUGCCCUUUCACCCUGUGGGA AUGCCCUUUCACCCUGUGGAA AUGCCCUUUCACCCUGUGGGA ACAAAUUCCACCUGUGGAA AUGCCCUUUCACCCUGUGGAA AUGCCCUGUCACACGGA AUGCCCUGUCACACGGA AUGCCCUUUCACCCUGUGGAA AUGCCCUUUCACCCUGUGGAA AUGCCCUGUCACACGGA AUGCCCUUUCACCCUGUGGAA AUGCCCUUUCACCCUGUGGAA AUGCCCUUUCACCCUGUGGAA AUGCCCUUUCACCCUGUGGAA AUGCCCUUUCACCCUGUGAAAAAAAAAA
hsa-miR-105-5p UCAAAUGCUCAGACUCCUGUGG CCCACAGGAGUCUGAGCAUUUUGA AAAAGUGCUUACAGUGCAGGUA UACCUGCACUGUAAGCACUUUUU hsa-miR-106b UAAAGUGCUGACAGUGCAGAUA UAUCUGCACUGUCAGCACUUUUA AGCAGCAUUGUACAGGGCUAUC GAUAGCCCUGUACAAUGCUGCU ACAAAUUCGGUUCUACAGGGUA ACCAGUGAACCGAAUUUGU ACAAAUUCGGUUCUACAGGGUA AUGCCCUGUACAAUGCUGCU ACAAAUUCGGUUCACAGGGUA AUGCCCUUUCACAGGGUA AUGCCCUUUCAUCAUCACUGUGA AUGCCCUUUCAUCAUUGCACUG AUGCCCUUUCAUCAUUGCACUG AUGCCCUUUCAUCAUUGCACUG AUGCCCUUUCAUCAUUGCACUG AUGCCCUUUCAUCAUUGCACUG AUGCCCUUUCAUCAUUGCACUG AUGCCUUUCACCCUGUGGUA AUGCCCUUUCACCUUUACGG AUGAACAAAGAACACACGA UCCGUGGUUCUACCCUGUGGUA AUGCCUUUCUACCUUUAUGGG AUGAACAAAUGUAGAAAGCACUAC GUAGUGCUUUCUACCUUUAUGGG AUGAAAGAACACACGA UACCAGAGCGUUCACUUCAC
hsa-miR-106a AAAAGUGCUUACAGUGCAGGUA UACCUGCACUGUAAGCACUUUU hsa-miR-107 AGCAGCAUUGUACAGGGCUAUC GAUAGCCCUGUACAAUGCUGCU ACAAUUCGGUUCUACAGGGUA Hsa-miR-10b UACCCUGUAGAACCGAAUUUGU ACAAAUUCGGUUCUACAGGGUA ACAAAUUCGGUUCUACAGGGUA ACAAAUUCGGUUCUACAGGGUA ACAAAUUCGGUUCUACAGGGUA AUGCCCUUUCACCUGUGA AUGCCCUUUCAUCAUCAUUGCACUG AUGCCCUUUCAUCAUCAUUGCACUG AUGCCCUUUCAUCAUCAUUGCACUG AUGCCCUUUCAUCAUCAUUGCACUG AUGCCCUUUCACCUGUGGUA AUGCCCUUUCUACCCUGUGGUA AUGCCCUUUCUACCCUGUGGUA AUGCCCUUUCUACCUUUAUGGG AUGACACAGGCACUAC GUAGUGCUUUCUACCUUUAUGGG AUGACACAGGGUAAAGCACUAC GUAGUGCUUUCUACCUUUAUGGG AUGACACAGGCUUCACAGGUCUAGUA AUGCCUUUCUACCUUUAUGGG AUGACACGAGCGUUGAAUGUU ACCCUAACAGACCACGA CCCCUAUCACGAUUAGCAUUAA AACAUUCAACGCUGUCGGUGAG CCCCCUAUCACGAUUAGCAUUAA AACAUUCAACGCUGUCGGUGAG CCCCCCACCGACAGCGUUGAAUGUU AACAUUCAUUGCUGUCGGUGGG CCCCACCGACAGCGUUGAAUGUU
hsa-miR-106b UAAAGUGCUGACAGUGCAGAUA hsa-miR-107 AGCAGCAUUGUACAGGGCUAUC hsa-miR-10b UACCCUGUAGAACCGAAUUUGU ACAAAUUCGGUUCUACAGGGUA hsa-miR-128b UCACAGUGAACCGGUCUCUUUC hsa-miR-130b CAGUGCAAUGAUGAAAGGGCAU hsa-miR-140-3p UACCACAGGGUAGAACCACGA UCCGUGUUCAUCAUCAUUGCACUG hsa-miR-142-5p CCCAUAAAGUAGAAACCACGA UCCGUGUUUCUACCCUGUGGUA hsa-miR-151-5p UCGAGGAGCUCACAGUCUAGUA UACUAGACUGUGACCUCUCUU CUCCUUUCAUCAUUAUCGG UUCACCGACGGUUCACCUCUCGA CCCCUAUCACGAUUAACCACUCA hsa-miR-155 UUAAUGCUAAUCGUGAUAGGGG CCCCCUAUCACGAUUAACCAUUAA hsa-miR-181a AACAUUCAACGCUGUCGGUGAG CCCACCGACAGCGUUGAAUGUU
hsa-miR-107 hsa-miR-10b UACCCUGUAGAACCGAAUUUGU hsa-miR-128b UCACAGUGAACCGGUCUCUUUC hsa-miR-130b CAGUGCAAUGAUGAAGGGCAU hsa-miR-140-3p UACCACAGGGUAGAACCAGGA hsa-miR-142-5p CCCAUAAAGUAGAAAGCACUAC hsa-miR-151-5p UCGAGGAGCUCACAGUCUAGUA hsa-miR-155 UUAAUGCUAAUCGUGAAAGGAA hsa-miR-181a AACAUUCAUGGGCAUUCACAGGCUUACACGACGA CCCCUAUCACCGACGACUUACACGACGA CCCCUAUCACGAUUAACACGCUGUAAAGUUAACACGCUGGGGGCACAGCGUUGAAUGUU CCCCCCCCCC
hsa-miR-10b UACCCUGUAGAACCGAAUUUGU ACAAAUUCGGUUCUACAGGGUA hsa-miR-128b UCACAGUGAACCGGUCUCUUUC hsa-miR-130b CAGUGCAAUGAUGAAAGGGCAU AUGCCCUUUCAUCAUCAUGACAUG hsa-miR-140-3p UACCACAGGGUAGAACCACGGA UCCGUGGUUCUACCUGUGGUA hsa-miR-142-5p CCCAUAAAGUAGAAAGCACUAC hsa-miR-151-5p UCGAGGAGCUCACAGUCUAGUA UACUAGACUGUGAGCUCCUCGA hsa-miR-155 UUAAUGCUAAUCGUGAUAGGGG CCCCUAUCACGAUUAACAUGAAUGUU hsa-miR-181a AACAUUCAACGCUGUCGGUGAG CUCACCGACAGCGUUGAAUGUU hsa-miR-181b AACAUUCAUUGCUGUCGGUGGG CCCACCGACAGCAUGAAUGUU
hsa-miR-128b UCACAGUGAACCGGUCUCUUUC GAAAGAGACCGGUUCACUGUGA hsa-miR-130b CAGUGCAAUGAUGAAAGGGCAU AUGCCCUUUCAUCAUUGCACUG hsa-miR-140-3p UACCACAGGGUAGAACCACGGA UCCGUGGUUCUACCCUGUGGUA hsa-miR-142-5p CCCAUAAAGUAGAAAGCACUAC GUAGUGCUUUCUACUUUAUGGG hsa-miR-151-5p UCGAGGAGCUCACAGUCUAGUA UACUAGACUGUGAGCUCCUCGA hsa-miR-155 UUAAUGCUAAUCGUGAUAGGGG CCCCUAUCACGAUUAGCAUUAA hsa-miR-181a AACAUUCAACGCUGUCGGUGAG CUCACCGACAGCGUUGAAUGUU hsa-miR-181b AACAUUCAUUGCUGGUGGG CCCACCGACAGCAAUGAAUGUU
hsa-miR-130b CAGUGCAAUGAUGAAAGGGCAU AUGCCCUUUCAUCAUUGCACUG hsa-miR-140-3p UACCACAGGGUAGAACCACGGA UCCGUGGUUCUACCUUGUGGUA hsa-miR-142-5p CCCAUAAAGUAGAAAGCACUAC GUAGUGCUUUCUACUUUAUGGG hsa-miR-151-5p UCGAGGAGCUCACAGUCUAGUA UACUAGACUGUGAGCUCCUCGA hsa-miR-155 UUAAUGCUAAUCGUGAUAGGGG CCCCUAUCACGAUUAGCAUUAA hsa-miR-181a AACAUUCAACGCUGUCGGUGAG CUCACCGACAGCGUUGAAUGUU hsa-miR-181b AACAUUCAUUGCUGUCGGUGGG CCCACCGACAGCAUGAAUGUU
hsa-miR-140-3p UACCACAGGGUAGAACCACGGA UCCGUGGUUCUACCCUGUGGUA hsa-miR-142-5p CCCAUAAAGUAGAAAGCACUAC GUAGUGCUUUCUACUUUAUGGG hsa-miR-151-5p UCGAGGAGCUCACAGUCUAGUA UACUAGACUGUGAGCUCCUCGA hsa-miR-155 UUAAUGCUAAUCGUGAUAGGGG CCCCUAUCACGAUUAGCAUUAA hsa-miR-181a AACAUUCAACGCUGUCGGUGAG CUCACCGACAGCGUUGAAUGUU hsa-miR-181b AACAUUCAUUGCUGUCGGUGGG CCCACCGACAGCAUGAAUGUU
hsa-miR-142-5p CCCAUAAAGUAGAAAGCACUAC GUAGUGCUUUCUACUUUAUGGG hsa-miR-151-5p UCGAGGAGCUCACAGUCUAGUA UACUAGACUGUGAGCUCCUCGA hsa-miR-155 UUAAUGCUAAUCGUGAUAGGGG CCCCUAUCACGAUUAGCAUUAA hsa-miR-181a AACAUUCAACGCUGUCGGUGAG CUCACCGACAGCGUUGAAUGUU hsa-miR-181b AACAUUCAUUGCUGUCGGUGGG CCCACCGACAGCAUGAAUGUU
hsa-miR-151-5p UCGAGGAGCUCACAGUCUAGUA UACUAGACUGUGAGCUCCUCGA hsa-miR-155 UUAAUGCUAAUCGUGAUAGGGG CCCCUAUCACGAUUAGCAUUAA hsa-miR-181a AACAUUCAACGCUGUCGGUGAG CUCACCGACAGCGUUGAAUGUU hsa-miR-181b AACAUUCAUUGCUGUCGGUGGG CCCACCGACAGCAAUGAAUGUU
hsa-miR-155 UUAAUGCUAAUCGUGAUAGGGG CCCCUAUCACGAUUAGCAUUAA hsa-miR-181a AACAUUCAACGCUGUCGGUGAG CUCACCGACAGCGUUGAAUGUU hsa-miR-181b AACAUUCAUUGCUGUCGGUGGG CCCACCGACAGCAAUGAAUGUU
hsa-miR-181a AACAUUCAACGCUGUCGGUGAG CUCACCGACAGCGUUGAAUGUU hsa-miR-181b AACAUUCAUUGCUGUCGGUGGG CCCACCGACAGCAAUGAAUGUU
hsa-miR-181b AACAUUCAUUGCUGUCGGUGGG CCCACCGACAGCAAUGAAUGUU
hsa-miR-181c AACAUUCAACCUGUCGGUGAGU ACUCACCGACAGGUUGAAUGUU
hsa-miR-182 UUUGGCAAUGGUAGAACUCACA UGUGAGUUCUACCAUUGCCAAA
hsa-miR-183 UAUGGCACUGGUAGAAUUCACU AGUGAAUUCUACCAGUGCCAUA
hsa-miR-184 UGGACGGAGAACUGAUAAGGGU ACCCUUAUCAGUUCUCCGUCCA
hsa-miR-185 UGGAGAGAAAGGCAGUUCCUGA UCAGGAACUGCCUUUCUCCCA
hsa-miR-186 CAAAGAAUUCUCCUUUUGGGCU AGCCCAAAAGGAGAAUUCUUUG
hsa-miR-187 UCGUGUCUUGUGUUGCAGCCGG CCGGCUGCAACACAAGACACGA
hsa-miR-188-3p CUCCCACAUGCAGGGUUUGCAG CUGCAAACCCUGCAUGUGGGAG
hsa-miR-188-5p CAUCCCUUGCAUGGUGGAGGGU ACCCUCCACCAUGCAAGGGAUG
hsa-miR-189 GUGCCUACUGAGCUGAUAUCAG CUGAUAUCAGCUCAGUAGGCAC
hsa-miR-190 UGAUAUGUUUGAUAUAUUAGGU ACCUAAUAUAUCAAACAUAUCA
hsa-miR-191 CAACGGAAUCCCAAAAGCAGCU AGCUGCUUUUUGGGAUUCCGUUG
hsa-miR-192 CUGACCUAUGAAUUGACAGCCA UGGCUGUCAAUUCAUAGGUCAG
hsa-miR-193-3p AACUGGCCUACAAAGUCCCAGU ACUGGGACUUUGUAGGCCAGUU
hsa-miR-193-5p UGGGUCUUUGCGGGCAAGAUGA UCAUCUUGCCCGCAAAGACCCA
hsa-miR-194 UGUAACAGCAACUCCAUGUGGA UCCACAUGGAGUUGCUGUUACA
hsa-miR-195 UAGCAGCACAGAAAUAUUGGCA UGCCAAUAUUUCUGUGCUGCUA
hsa-miR-196 UAGGUAGUUUCAUGUUGUUGGG CCCAACAACAUGAAACUACCUA
hsa-miR-197 UUCACCACCUUCUCCACCCAGC GCUGGGUGGAGAAGGUGGUGAA
hsa-miR-198 GGUCCAGAGGGGAGAUAGGUUC GAACCUAUCUCCCCUCUGGACC
hsa-miR-199a-3p ACAGUAGUCUGCACAUUGGUUA UAACCAAUGUGCAGACUACUGU
hsa-miR-199a-5p CCCAGUGUUCAGACUACCUGUU AACAGGUAGUCUGAACACUGGG

microRNA name	mi gree DNA GOOTH CO	7 1 7 7 7 7
microrna name	microRNA sequence	Anti-microRNA molecule
h	(5' to 3')	sequence (5' to 3')
hsa-miR-199b	CCCAGUGUUUAGA CUAUCUGUU	AACAGAUAGUCUAAACACUGGG
hsa-miR-200a	UAACACUGUCUGGUAACGAUGU	ACAUCGUUACCAGACAGUGUUA
hsa-miR-200b	CUCUAAUACUGCCUGGUAAUGA	UCAUUACCAGGCAGUAUUAGÁG
hsa-miR-200c	AAUACUGCCGGGUAAUGAUGGA	UCCAUCAUUACCCGGCAGUAUU
hsa-miR-203	GUGAAAUGUUUAGGACCACUAG	CUAGUGGUCCUAAACAUUUCAC
hsa-miR-204	UUCCCUUUGUCAUCCUAUGCCU	AGGCAUAGGAUGACAAAGGGAA
hsa-miR-205	UCCUUCAUUCCAC CGGAGUCUG	CAGACUCCGGUGGAAUGAAGGA
hsa-miR-206	UGGAAUGUAAGGA.AGUGUGUGG	CCACACACUUCCUUACAUUCCA
hsa-miR-208	AUAAGACGAGCAA.AAAGCUUGU	ACAAGCUUUUUGCUCGUCUUAU
hsa-miR-210	CUGUGCGUGUGACAGCGGCUGA	UCAGCCGCUGUCACACGCACAG
hsa-miR-211	UUCCCUUUGUCAU CCUUCGCCU	AGGCGAAGGAUGACAAAGGGAA
hsa-miR-212	UAACAGUCUCCAGUCACGGCCA	UGGCCGUGACUGGAGACUGUUA
hsa-miR-213	ACCAUCGACCGUUGAUUGUACC	GGUACAAUCAACGGUCGAUGGU
hsa-miR-214	ACAGCAGGCACAGACAGGCAGU	ACUGCCUGUCUGUGCCUGU
hsa-miR-215	AUGACCUAUGAAUUGACAGACA	UGUCUGUCAAUUCAUAGGUCAU
hsa-miR-216	UAAUCUCAGCUGG CAACUGUGA	UCACAGUUGCCAGCUGAGAUUA
hsa-miR-217	UACUGCAUCAGGA ACUGAUUGG	CCAAUCAGUUCCUGAUGCAGUA
hsa-miR-218	UUGUGCUUGAUCUAACCAUGUG	CACAUGGUUAGAUCAAGCACAA
hsa-miR-219	UGAUUGUCCAAACGCAAUUCUU	AAGAAUUGCGUUUGGACAAUCA
hsa-miR-220	CCACACCGUAUCUGACACUUUG	CAAAGUGUCAGAUACGGUGUGG
hsa-miR-221	AGCUACAUUGUCUGCUGGGUUU	AAACCCAGCAGACAAUGUAGCU
hsa-miR-222	AGCUACAUCUGGCUACUGGGUC	GACCCAGUAGCCAGAUGUAGCU
hsa-miR-223	UGUCAGUUUGUCAAAUACCCCA	UGGGUAUUUGACAAACUGACA
hsa-miR-224	CAAGUCACUAGUGGUUCCGUUU	
hsa-miR-28-5p	AAGGAGCUCACAGUCUAUUGAG	AAACGGAACCACUAGUGACUUG CUCAAUAGACUGUGAGCUCCUU
hsa-miR-290	CUCAAACUGUGGGGGCACUUUC	GAAAGUGCCCCCACAGUUUGAG
hsa-miR-296	AGGGCCCCCCCCAAUCCUGUU	
hsa-miR-299	UGGUUUACCGUCCACAUACAU	AACAGGAUUGAGGGGGGCCCU
hsa-miR-301		AUGUAUGUGGGACGGUAAACCA
hsa-miR-301	CAGUGCAAUAGUAUUGUCAAAG	CUUUGACAAUACUAUUGCACUG
	UAAGUGCUUCCAUGUUUUGGUG	CACCAAAACAUGGAAGCACUUA
hsa-miR-30e	UGUAAACAUCCUUGACUGGAAG	CUUCCAGUCAAGGAUGUUUACA
hsa-miR-320	AAAAGCUGGGUUGAGAGGGCGA	UCGCCCUCUCAACCCAGCUUUU
hsa-miR-321	UAAGCCAGGGAUUGUGGGUUCG	CGAACCCACAAUCCCUGGCUUA
hsa-miR-322	AAACAUGAAUUGCUGCUGUAUC	GAUACAGCAGCAAUUCAUGUUU
hsa-miR-323	GCACAUUACACGGUCGACCUCU	AGAGGUCGACCGUGUAAUGUGC
hsa-miR-324-3p	CCACUGCCCAGGUGCUGCUGG	CCAGCAGCACCUGGGGCAGUGG
hsa-miR-324-5p	CGCAUCCCCUAGGGCAUUGGUG	CACCAAUGCCCUAGGGGAUGCG
hsa-miR-326	CCUCUGGGCCCUUCCUCCAGCC	GGCUGGAGGAAGGCCCAGAGG
hsa-miR-328	CUGGCCCUCUCUGCCCUUCCGU	ACGGAAGGCCAGAGAGGCCCAG
hsa-miR-329	AACACACCCAGCUAACCUUUUU	AAAAAGGUUAGCUGGGUGUGUU
hsa-miR-34a	UGGCAGUGUCUUAGCUGGUUGU	ACAACCAGCUAAGACACUGCCA
hsa-miR-34b	AGGCAGUGUCAUUAGCUGAUUG	CAAUCAGCUAAUGACACUGCCU
hsa-miR-34c	AGGCAGUGUAGUUAGCUGAUUG	CAAUCAGCUAACUACACUGCCU
hsa-miR-92	UAUUGCACUUGUCCCGGCCUGU	ACAGGCCGGGACAAGUGCAAUA
hsa-miR-93	AAAGUGCUGUUCGUGCAGGUAG	CUACCUGCACGAACAGCACUUU
hsa-miR-95	UUCAACGGGUAUUUAUUGAGCA	UGCUCAAUAAAUACCCGUUGAA
hsa-miR-96	UUUGGCACUAGCACAUUUUUGC	GCAAAAAUGUGCUAGUGCCAAA
hsa-miR-98	UGAGGUAGUAAGUUGUAUUGUU	AACAAUACAACUUACUACCUCA
mmu-miR-106a	CAAAGUGCUAACAGUGCAGGUA	UACCUGCACUGUUAGCACUUUG
mmu-miR-10b	CCCUGUAGAACCGAAUUUGUGU	ACACAAAUUCGGUUCUACAGGG
mmu-miR-135b	UAUGGCUUUUCAUUCCUAUGUG	CACAUAGGAAUGAAAAGCCAUA

microRNA name	mi graphy grants	
microrna name	microRNA sequence	Anti-microRNA molecule
mm	(5' to 3')	sequence (5' to 3')
mmu-miR-148b	UCAGUGCAUCACAGAACUUUGU	ACAAAGUUCUGUGAUGCACUGA
mmu-miR-151-3p	CUAGACUGAGGCUCCUUGAGGA	UCCUCAAGGAGCCUCAGUCUAG
mmu-miR-155	UUAAUGCUAAUUGUGAUAGGGG	CCCCUAUCACAAUUAGCAUUAA
mmu-miR-199b	CCCAGUGUUUAGACUACCUGUU	AACAGGUAGUCUAAACACUGGG
mmu-miR-200b	UAAUACUGCCUGGUAAUGAUGA	UCAUCAUUACCAGGCAGUAUUA
mmu-miR-203	UGAAAUGUUUAGGACCACUAGA	UCUAGUGGUCCUAAACAUUUCA
mmu-miR-211	UUCCCUUUGUCAUCCUUUGCCU	AGGCAAAGGAUGACAAAGGGAA
mmu-miR-217	UACUGCAUCAGGAACUGACUGG	CCAGUCAGUUCCUGAUGCAGUA
mmu-miR-224	UAAGUCACUAGUGGUUCCGUUU	AAACGGAACCACUAGUGACUUA
mmu-miR-28-3p	CACUAGAUUGUGAGCUGCUGGA	UCCAGCAGCUCACAAUCUAGUG
mmu-miR-290	CUCAAACUAUGGGGG CACUUUU	AAAAGUGCCCCAUAGUUUGAG
mmu-miR-291-3p	AAAGUGCUUCCACUUUGUGUGC	GCACAAAGUGGAAGCACUUU
mmu-miR-291-5p	CAUCAAAGUGGAGGC CCUCUCU	AGAGAGGCCUCCACUUUGAUG
mmu-miR-292-3p	AAGUGCCGCCAGGUUUUGAGUG	CACUCAAAACCUGGCGGCACUU
mmu-miR-292-5p	ACUCAAACUGGGGGCUCUUUUG	CAAAAGAGCCCCCAGUUUGAGU
mmu-miR-293	AGUGCCGCAGAGUUUGUAGUGU	ACACUACAAACUCUGCGGCACU
mmu-miR-294	AAAGUGCUUCCCUUUUGUGUGU	ACACAAAAAGGGAAGCACUUU
mmu-miR-295	AAAGUGCUACUACUUUUGAGUC	GACUCAAAAGUAGUAGCACUUU
mmu-miR-297	AUGUAUGUGCAUGUGCAUGU	
mmu-miR-298	GGCAGAGGAGGCUGUUCUUCC	ACAUGCACAUGCACAUACAU
mmu-miR-300	UAUGCAAGGGCAAGCUCUCUUC	GGAAGAACAGCCCUCCUCUGCC
mmu-miR-31		GAAGAGAGCUUGCCCUUGCAUA
mmu-miR-322	AGGCAAGAUGCUGGCAUAGCUG	CAGCUAUGCCAGCAUCUUGCCU
mmu-miR-325	AAACAUGAAGCGCUGCAACACC	GGUGUUGCAGCGCUUCAUGUUU
	CCUAGUAGGUGCUCAGUAAGUG	CACUUACUGAGCACCUACUAGG
mmu-miR-326	CCUCUGGGCCCUUCCUCCAGUC	GACUGGAGGAAGGCCCAGAGG
mmu-miR-330	GCAAAGCACAGGGCCUGCAGAG	CUCUGCAGGCCCUGUGCUUUGC
mmu-miR-331	GCCCCUGGGCCUAUCCUAGAAC	GUUCUAGGAUAGGCCCAGGGGC
mmu-miR-337	UUCAGCUCCUAUAUGAUGCCUU	AAGGCAUCAUAUAGGAGCUGAA
mmu-miR-338	UCCAGCAUCAGUGAUUUUGUUG	CAACAAAUCACUGAUGCUGGA
mmu-miR-339	UCCCUGUCCUCCAGGAGCUCAC	GUGAGCUCCUGGAGGACAGGGA
mmu-miR-340	UCCGUCUCAGUUACUUUAUAGC	GCUAUAAAGUAACUGAGACGGA
mmu-miR-341	UCGAUCGGUCGGUCAGUC	GACUGACCGACCGAUCGA
mmu-miR-342	UCUCACACAGAAAUCGCACCCG	CGGGUGCGAUUUCUGUGUGAGA
mmu-miR-344	UGAUCUAGCCAAAGC CUGACUG	CAGUCAGGCUUUGGCUAGAUCA
mmu-miR-345	UGCUGACCCCUAGUC CAGUGCU	AGCACUGGACUAGGGGUCAGCA
mmu-miR-346	UGUCUGCCCGAGUGCCUGCCUC	GAGGCAGGCACUCGGGCAGACA
mmu-miR-34b	UAGGCAGUGUAAUUAGCUGAUU	AAUCAGCUAAUUACACUGCCUA
mmu-miR-350	UUCACAAAGCCCAUACACUUUC	GAAAGUGUAUGGGCUUUGUGAA
mmu-miR-351	UCCCUGAGGAGCCCUTUGAGCC	GGCUCAAAGGGCUCCUCAGGGA
mmu-miR-7b	UGGAAGACUUGUGAUUUUGUUG	CAACAAAAUCACAAGUCUUCCA
mmu-miR-92	UAUUGCACUUGUCCCGGCCUGA	UCAGGCCGGGACAAGUGCAAUA
mmu-miR-93	CAAAGUGCUGUUCGUGCAGGUA	UACCUGCACGAACAGCACUUUG
rno-miR-327	CCUUGAGGGCAUGAGGGUAGU	ACUACCCUCAUGCCCCUCAAGG
rno-miR-333	GUGGUGCUAGUUACUUUUGG	CCAAAAGUAACUAGCACACCAC
rno-miR-335	UCAAGAGCAAUAACGAAAAAUG	CAUUUUUCGUUAUUGCUCUUGA
rno-miR-336	UCACCCUUCCAUAUCUAGUCUC	
rno-miR-343	UCUCCCUCCGUGUGCCCAGUAU	GAGACUAGAUAUGGAAGGGUGA
rno-miR-347	UGUCCCUCUGGGUCGCCCAGCU	AUACUGGGCACACGGAGGGAGA
rno-miR-349		AGCUGGGCGACCCAGAGGGACA
rno-miR-352	CAGCCCUGCUGUCUUAACCUCU	AGAGGUUAAGACAGCAGGGCUG
710 m11-332	AGAGUAGUAGGUUGCAUAGUAC	GUACUAUGCAACCUACUACUCU

Table 2: Novel Human microRNA and anti-microRNA sequences.

microRNA name	microRNA sequence (5' to 3')	Anti-microRNA molecule sequence (5' to 3')
hsa-miR-361	UUAUCAGAAUCUCCAGGGGUAC	GUACCCCUGGAGAUUCUGAUAA
hsa-miR-362	AAUCCUUGGAACCUAGGUGUGA	UCACACCUAGGUUCCAAGGAUU
hsa-miR-363	AUUGCACGGUAUCCAUCUGUAA	UUACAGAUGGAUACCGUGCAAU
hsa-miR-364	CGGCGGGACGGCGAUUGGUCC	GGACCAAUCGCCGUCCCCGCCG
hsa-miR-365	UAAUGCCCCUAAAAAUCCUUAU	AUAAGGAUUUUUAGGGGCAUUA
hsa-miR-366	UAACUGGUUGAACAACUGAACC	GGUUCAGUUGUUCAACCAGUUA

Table 3: C. elegans microRNA and anti-microRNA sequences.

microRNA name	microRNA sequence	Anti-microRNA molecule
	(5' to 3')	sequence (5' to 3')
Cel-let-7	UGAGGUAGUUGUAUAGUU	AACUAUACAACCUACUACCUCA
Cel-lin-4	UCCCUGAGACCUCAAGUGUGAG	CUCACACUUGAGGUCUCAGGGA
Cel-miR-1	UGGAAUGUAAAGAAGUAUGUAG	CUACAUACUUCUUUACAUUCCA
Cel-miR-2	UAUCACAGCCAGCUUUGAUGUG	CACAUCAAAGCUGGCUGUGAUA
Cel-miR-34	AGGCAGUGUGGUUAGCUGGUUG	CAACCAGCUAACCACACUGCCU
Cel-miR-35	UCACCGGGUGGAAACUAGCAGU	ACUGCUAGUUUCCACCCGGUGA
Cel-miR-36	UCACCGGGUGAAAAUUCGCAUG	CAUGCGAAUUUUCACCCGGUGA
Cel-miR-37	UCACCGGGUGAACACUUGCAGU	ACUGCAAGUGUUCACCCGGUGA
Cel-miR-38	UCACCGGGAGAAAACUGGAGU	ACUCCAGUUUUUCUCCCGGUGA
Cel-miR-39	UCACCGGGUGUAAAUCAGCUUG	CAAGCUGAUUUACACCCGGUGA
Cel-miR-40	UCACCGGGUGUA CAUCAGCUAA	UUAGCUGAUGUACACCCGGUGA
Cel-miR-41	UCACCGGGUGAAAAAUCACCUA	UAGGUGAUUUUUCACCCGGUGA
Cel-miR-42	CACCGGGUUAACAUCUACAGAG	CUCUGUAGAUGUUAACCCGGUG
Cel-miR-43	UAUCACAGUUUACUUGCUGUCG	CGACAGCAAGUAAACUGUGAUA
Cel-miR-44	UGACUAGAGACACAUUCAGCUU	AAGCUGAAUGUGUCUCUAGUCA
Cel-miR-45	UGACUAGAGACACAUUCAGCUU	AAGCUGAAUGUGUCUCUAGUCA
Cel-miR-46	UGUCAUGGAGUCGCUCUCUCA	UGAAGAGAGCGACUCCAUGACA
Cel-miR-47	UGUCAUGGAGGCGCUCUCUUCA	UGAAGAGAGCGCCUCCAUGACA
Cel-miR-48	UGAGGUAGGCUCAGUAGAUGCG	CGCAUCUACUGAGCCUACCUCA
Cel-miR-49	AAGCACCACGAGAAGCUGCAGA	UCUGCAGCUUCUCGUGGUGCUU
Cel-miR-50	UGAUAUGUCUGGUAUUCUUGGG	CCCAAGAAUACCAGACAUAUCA
Cel-miR-51	UACCCGUAGCUCCUAUCCAUGU	ACAUGGAUAGGAGCUACGGGUA
Cel-miR-52	CACCCGUACAUAUGUUUCCGUG	CACGGAAACAUAUGUACGGGUG
Cel-miR-53	CACCCGUACAUUUGUUUCCGUG	CACGGAAACAAAUGUACGGGUG
Cel-miR-54	UACCCGUAAUCUUCAUAAUCCG	CGGAUUAUGAAGAUUACGGGUA
Cel-miR-55	UACCCGUAUAAGUUUCUGCUGA	UCAGCAGAAACUUAUACGGGUA
Cel-miR-56	UACCCGUAAUGUUUCCGCUGAG	CUCAGCGGAAACAUUACGGGUA
Cel-miR-57	UACCCUGUAGAUCGAGCUGUGU	ACACAGCUCGAUCUACAGGGUA
Cel-miR-58	UGAGAUCGUUCAGUACGGCAAU	AUUGCCGUACUGAACGAUCUCA
Cel-miR-59	UCGAAUCGUUUAUCAGGAUGAU	AUCAUCCUGAUAAACGAUUCGA
Cel-miR-60	UAUUAUGCACAUUUUCUAGUUC	GAACUAGAAAAUGUGCAUAAUA
Cel-miR-61	UGACUAGAACCGUUACUCAUCU	AGAUGAGUAACGGUUCUAGUCA
Cel-miR-62	UGAUAUGUAAUCUAGCUUACAG	CUGUAAGCUAGAUUACAUAUCA
Cel-miR-63	AUGACACUGAAGCGAGUUGGAA	UUCCAACUCGCUUCAGUGUCAU

Cel - miR - 64	microRNA name	microPNA company	77
Cel - miR - 65 UAUGACACUGARAGCGUUACCGA UCGGUACACUCUCAUGA Cel - miR - 65 CAUGACACUGAUUAGGGAUGUG UCGGUUACGCUUCAGUUCAGGAUGUG Cel - miR - 66 CAUGACACUCCUCAGAAAGAGUA UCGCAUCCCUAAUCGGUUGUGCACA Cel - miR - 67 UCCACACCUCCUCAGAAAGAGUA UACUCUUUCUAGGAGUUCUCGA Cel - miR - 68 UCGAAAAGUGUAAAAGUGUAGAA UUCUACACUUUUUAGUUCUCCA Cel - miR - 70 UAAUACGUCGUUGGUGUUUCCA UGGAACACCACGGUUUUCA Cel - miR - 71 UGAAAGUGUAGCAGUGAGC CGUUCACUACCCAACCGACUUUCA Cel - miR - 72 UGGCAAGAAUGGUAGCCACCGGCUUCA UGUAGCCCAACCGGCUUCA Cel - miR - 73 UGGCAAGAAAUGGAGCAUCCAA UGUAGCCGAACCGACUUCCA Cel - miR - 74 UGGCAAGAAAUGGCAGCUUCCA UGAACCUCACACCGGCUUCA Cel - miR - 75 UUCAAGGCCUACCAACCGGCUUCA UGAAGCCGAUGGCUGCAAGCU Cel - miR - 76 UUCAAGGCCUACCAAACCU UGAACCCAACCGACCCCCACACGACCU Cel - miR - 78 UGAGACCAAGCCAACCGCCUCCAAACCU UGAACCCAACCAACCCACCGCUCAACGACCACCCCCCAAACCU Cel - miR - 80 UGAGAUCAUAGUUGAAAACCC CGCCUUUCAACACCAACCAACCACCCCCCAACCCCACCACCA	micionna mame	microRNA sequence	Anti-microRNA molecule
Cel - miR - 65 URUGACACUGAROCIDA ROCCEA UCGGUIAGGUUCAGU Cel - miR - 66 CAUGACACUGAUUAGGAUGUG CACAUCCCUCAGARAGAGUA Cel - miR - 68 UCGARAGCUCCUAGARAGAGUA UACUCUUCUAGAGGGUUCUGCA Cel - miR - 69 UCGARAGUUGARAGAGUA UUCUACACCUUCUUGAGUUUUCCA Cel - miR - 70 UARAGCUCGUUGUUGUUCCA UGGARACACCAACGACGUUUU Cel - miR - 71 UGARAGACAUGGUUGUGUUUCCA UGGARACACCAACGACGUUUUA Cel - miR - 72 AGGCAAGAUGUUGGCAUAGCUU CAGCUUAUGCCAACCCACCGUUCA Cel - miR - 73 UGGCARGARAGUGGAGUUCUACA UGUAGACUGACUACA Cel - miR - 74 UGGCARGARAGUGGAGUUCUACA UGUAGACCGCUUCA Cel - miR - 75 UUCAUCAGGCCALAGCUUUCA UGARGCGGUUCAACCAGCUUCA Cel - miR - 77 UUCAUCAGGCCALAGCUUUCCCA UGGACACAGUAGAUGAUUCCCA Cel - miR - 79 AURAGCUUGACAAGAGCU AGCACAACCAACCAGCGCUUCA Cel - miR - 79 AURAGCUUGACAAGAGCU AGCACAACAACACACGAGCUUCA Cel - miR - 81 UGACAUCAUUCUCUCACAAGCU AGCACAACAACACACAGAGCUUCAC Cel - miR - 82 UGACAUCAUUCAGACUAAACUACUCAGAGUACCCCCACAGU ACUAGCUUUCACAAAAACACACAUCUCCCCAAGUACACUAAUAACUCACCAGAGCACCCAGAGCACCACCAGAGCACACACA	Col min 64		
Cel-miR-66 Cel-miR-67 Cel-miR-67 Cel-miR-68 UCGAAGCUCANAAAGGAU Cel-miR-68 UCGAAGCUCANAAAGGAU Cel-miR-69 UCGAAGCUCANAAAGGAC GULAMAACUUUUUUAGGAGGUUUUCA Cel-miR-70 UAANAAAGUUCAAAAAGUUUCA Cel-miR-71 UGAAAGACUCANAAAAGUUUCA Cel-miR-71 UGAAAGACAUGGUGGGUUUCCA Cel-miR-72 AGGCAAGAGUGUGGGCANAGCU Cel-miR-73 UGGCAAGAUGUGGGCANAGCU Cel-miR-73 UGGCAAGAUGUGGGCANAGCU Cel-miR-73 UGGCAAGAAAUGAAAAGUGCAACACCAACCAACCAACGACUUUUCA Cel-miR-73 UGGCAAGAUGUUGGCANAGCU Cel-miR-74 UGGCAAGAAAUGAAAAGGCAUCACA Cel-miR-75 UUAAAGCUACCAUCUUCA Cel-miR-76 UUCGUUGUUGAAAAAGUUCAA Cel-miR-77 UUCAUCAGGCCAUGACUUCA Cel-miR-77 UUCAUCAGGCCAUGACUUCA Cel-miR-77 UUCAUCAGGCCAUGACUUCA Cel-miR-78 UUCGUUGUUGAAAAGCAU Cel-miR-79 UUCAUCAGGCCUAGAUGUUCA Cel-miR-79 UUCAUCAGGCCUUGA UUCAAGCUUCAACAACGAC Cel-miR-79 UUCAUCAGGCCUAGAUGUUCA Cel-miR-79 UUCAUCAGGCCUAGAUGUUCA Cel-miR-79 UUCAUCAGGCCUAGAUGUUCA Cel-miR-80 UGAGAUCAUGAUUAGUAAAGCU Cel-miR-81 UGAGAUCAUCAUGAAAGCU Cel-miR-81 UGAGAUCAUCAUGAAAGCU Cel-miR-82 UGAGAUCAUCAUGAAAGCU Cel-miR-83 UACCACCAUAAAAGUUAGUAA CCL-miR-84 UGAGAUCAUCAUGAAAGCUAG Cel-miR-85 UAAAGGAUAUGUUGAAAGCUAGU Cel-miR-86 UAAGGUAUUUGAAAAGUUAGUAA Cel-miR-87 UGAGAUCAUCAUGAAAGCUAGU Cel-miR-88 UAACACCAUAUAAAUUCAGUAA UUACACAACAACACAGAGAUCUCA Cel-miR-89 UGAGAUCAUCAUGAAAGCUAGU Cel-miR-89 UAAAGCACAACAACACCAGGCUCCA Cel-miR-89 UAAAGCACAACAACAACACCAGGCUACA Cel-miR-89 UAAAGCACCAUAUAAAUUCAGUAA UUACUGAAUUUUAACAGAUCUCA Cel-miR-89 UAAAGCACCAUAUAAAUUCAGUAA UUACUGAAUUCUCAAUACCUCA Cel-miR-89 UAAAGCACCAGGGUGAAAGCUAG Cel-miR-231 UAAAGCACCAGGGGGAAGCUC Cel-miR-231 UAAGCACCAGGGGGAAGCUCC Cel-miR-231 UAAGCACCAGGGGGGAAGGCC CCCCACGGGGGAAGCUUCAACACACACACACACACACACA		UAUGACACUGAAGCGUUACCGA	UCGGUAACGCUUCAGUGUCAUA
Cel-miR-67		UAUGACACUGAAGCGUAACCGA	UCGGUUACGCUUCAGUGUCAUA
Cel-mir-69 Cel-mir-70 UGANAAUUAAAAGUGUAGC Cel-mir-71 UGAAAGCAUGGUGUGUUUCCA UGGAAACUUCAACGCUUUUUAAUUUUCGA Cel-mir-71 UGAAAGCAUGGUGUGUUUCCA UGGAAACACCAACGACGACGAUUUUCCCA Cel-mir-72 UGCAAGAUGUUGGCAUAGCU Cel-mir-73 UGGCAAGAUGUUGGCAUAGCU Cel-mir-74 UGGCAAGAUGUUGGCAUAGCU Cel-mir-75 UUGAAGCAUCGCUUCA Cel-mir-75 UUGAAGCAUGUUGCCA Cel-mir-76 UUGAUGAAGAAUGUUGCCA Cel-mir-77 UUCAUCAGGCUUCA Cel-mir-77 UUCAUCAGGCUUCA Cel-mir-78 UUGGUAGCUUCACAUCUUUAA UCAAGCCUUUUAAUGCCAUCUUUAA Cel-mir-79 UUCAUCAGGCCUUCA Cel-mir-77 UUCAUCAGGCCUUCA Cel-mir-79 UUCAUCAGGCCUUCA Cel-mir-79 UUGAUGAGCUGCCAACCACCGGCUUCA Cel-mir-79 UUGAUCAGGCCUUCA Cel-mir-79 UUGAUCAGGCCUUCA Cel-mir-79 UUGAUCAGGCCUUCA Cel-mir-80 UGAGACCCAGCCUUCA Cel-mir-81 UGAGACCAGCAUGUUCCA Cel-mir-80 UGAGACCAUGAUGUUCCA Cel-mir-81 UGAGAUCAUCAGUUGAAAGCCU Cel-mir-82 UGAGACCAUAACAACACAGGCUUCA Cel-mir-83 UGAGACCAUAUAAGUUGAAAGCC Cel-mir-84 UGAGAUCAUCAGUUGAAAGCC Cel-mir-85 UAGAGUCAUCAGGUUGAAAGCCAGU Cel-mir-86 UAGAGUCAUCAGGAUAGCUAGU Cel-mir-87 UAGAGUCAUCAGGAAGCCAGU Cel-mir-87 Cel-mir-88 UAGAGCACAAACAACACAGGCCAGU Cel-mir-89 UACAAAGUAUUUGAAAGCCAGU Cel-mir-89 UACAAAGUAUUUGAAAGCCAGU Cel-mir-89 UACAAAGUAUUUGAAAGCCAGU Cel-mir-89 UACAAAGUAUUUGAAAGCCAGU Cel-mir-89 UACAAAGUAUUUGAAAGCCAGU Cel-mir-234 AUGACCACCUGAACCUUCCACAGU Cel-mir-234 AUGACCACCUGAACCUCCACAGU Cel-mir-234 UAAGCCACCUGAACCUUCCACAGU Cel-mir-234 UAAGCCACCUGAACCUUCCACAGU Cel-mir-235 UAAAGCCACCUGAACCUUCAAUCACUCCACGUGCCUUA Cel-mir-239 UUUGUACACACCUGCCACAGUG CCCCCCACAUUCAAACCACCUCCC Cel-mir-239 UUUGUACCACCAGGGCGCGGCGGGGCACCCCC Cel-mir-239 UUUGUACCACCACGGGGCGGGCACCCCC Cel-mir-239 UUUGUACCACCAUGAAGCCCCC Cel-mir-239 UUUGUACCACCAUGAAGCCCCC Cel-mir-239 UUUGUACCACACUGGGGGGGCCCCAACCCCGACCCUGACCCUCAACCCCCACCCCCCCC		CAUGACACUGAUUAGGGAUGUG	CACAUCCCUAAUCAGUGUCAUG
Cel-mir-70 UCGAAAAUUAAAAGUGUAGAA UUCUACACUUUUTAAUUUUCGA Cel-mir-71 UGAAAGCUGUUGGUGUUUUCCA UGGAAAACACCAACGACGACGACGUUUUCA Cel-mir-72 AGGCAAGAUGGUGGUGGUUCAG CGUUACUACCACGUUUUCA Cel-mir-73 LUGCAAGAUGUGGCAUGUCG CGAGCUAUGCCCAACAUUUUGCCA Cel-mir-74 UGGCAAGAAUGGCAGUUCUAA UGAAGCGCAUUUUCCA Cel-mir-75 UUCAUGGCCAUAGCUUCA UGAAGCGCUUUGA Cel-mir-76 UUCAUCAGGCAUAGCUUCA UCAAGGCUAUGCCAACGA Cel-mir-77 UUCAUCAGCAAAGCUUGA UCAAGGCUICAACAACAACACA Cel-mir-78 UUCAUCAGCACAAACCUUGUA AGCACAACAACAACGAGCUUCAA Cel-mir-79 AUAAAGCUAGUGAAAGCU AGCUUUGGAACCUAACGU Cel-mir-879 AUAAAGCUAGUGAAAGCUAGU AGCUUUGGAAUCAUGUGGAAAGCU Cel-mir-880 UGAGAUCAUUGAAAGCUAGU ACUAGCUUUCACAGAUGAUGU Cel-mir-81 UGAGAUCAUCAUGAAAGCUAGU ACUAGCUUUCACAGUGAUGUUCA Cel-mir-83 UACACACACAGAACGUU ACUAGCUUUCACAGUGAUCUCA Cel-mir-84 UGAGAUCAUUCAGAGAACAU ACUAGCUUUCACAGAUGAUCUCA Cel-mir-85 UACAAAGUUUCACAGAAACAUUUCAAAAAUUCACGA ACGACUUUCACAGAACAUUCUCACAAAAACAUUUCAAAAAAAUCAUCUCAAAAAA			UACUCUUUCUAGGAGGUUGUGA
Cel-miR-70 UAAUACGUCGUUGGUGUUUCCA UGGAAACACCAACGACGUGUUUCCA Cel-miR-71 UGAAAGACAUGGUUUGCAUGCUUCACCAAUGUCUUCCC Cel-miR-73 AGGCAAGAUGUUGGCAUGCUUCA CGUUACCAACCAAUGUUUGCCU Cel-miR-74 UGGCAAGAUGUUGGCAUUUCACA UGUAGACGACAUCUUGCCU Cel-miR-75 UUAAAGCUACCAACGGCUUCA UGLAGACGCAUUCUUGCA Cel-miR-76 UUCGUUGUUGAUGAAGCUUUCA UGAAGCCGUUCAUCAACAACGACCA Cel-miR-78 UGGAGGCCUGGUUGUUUGUUCCA UGAACCAACAACCAGGCCUUCA Cel-miR-79 AUAAAGCUAGGUUGCAACAGCU AGCACAAACAACCAGGCCUUCA Cel-miR-79 AUAAAGCUAGGUUGACAAGACU AGCACAAAACAACCAGGCCUUCA Cel-miR-79 AUAAAGCUAGGUUGAAAGCU AGCACAAAACAACCAGGCUUCA Cel-miR-8-1 UGAGAUCAUUGUGAAACCC GUUCAACAACAACAACAACAGCAGCCC Cel-miR-81 UGAGAUCAUCGUGAAAGCUAGU ACUAGGUUUCAACGAUGAUCUCA Cel-miR-82 UGACAACAUCUGUGAAAGCUAGU ACUAGCUUUCAACGAUGAUCUCA Cel-miR-83 UAGCACCACAAAAAUUCAGUAA UUACUGAAUUUAUAUGUGU Cel-miR-85 UAACAGUAGUUUCAACGAUGAU UUACUGAAUUUAUAUGUGU Cel-miR-86 UAACGUAAGUUUCAGGUUGU ACCACUUUCAACAUUUUCA Cel-miR-90		UCGAAGACUCAAAAGUGUAGAC	
Cel-mir-71 UGAAAGACAUGGGUAGUGAACG Cel-mir-72 AGGCAAGAUGUGCCAUGCUG Cel-mir-73 UGGCAAGAUGUGGCAGUUCAG Cel-mir-74 UGGCAAGAUGUGGCAGUUCAG Cel-mir-75 UUGAAGAGAAUGUGCCACCAGUUUCCCA Cel-mir-76 UUCGUUGUUGAUGAAGCUUCA UGAAGCCGAUUUGUUCA Cel-mir-77 UUCAUCAGGCCAUGUUCA UGAAGCCGUUGAUGAACACCACCAGCUUCA Cel-mir-77 UUCAUCAGGCCAUGUUCA UGAAGCCGGUUGAUGAA Cel-mir-79 AUAAAGCUAGCAGCUUCA UGAAGCCGUUGAUGAA Cel-mir-79 AUAAAGCUAGGAUGUUGCA UGAAGCAGAACAACCAGGCCUCCA Cel-mir-79 AUAAAGCUAGGUUUGAACCAAAGCU AGCACAAACAACCAGGCCUCCA Cel-mir-80 UGAGAUCAUGAACGCGCUUGA Cel-mir-81 UGAGAUCAUGAACGCGCGUGCA Cel-mir-82 UGAGAUCAUGACCAGGCCUCCA Cel-mir-83 UGAGAUCAUGAGCGCGCGCAAAGCU Cel-mir-83 UGAGAUCAUGAAGCCG Cel-mir-84 UGAAGCCAUAAGCCCCCCCAAAGCU Cel-mir-85 UACAAAGUAUUGAAAGCCG Cel-mir-86 UAAGGCACAAAGUUGGAAAGCCCCCCA-mir-86 UAAGGCACAAAGUUCGAAAGCCC Cel-mir-87 UACAAAGUAUUGAAAAGCCG Cel-mir-88 UGAGGAUCAUGGUAAAGCCAGU Cel-mir-89 UGAGAUCAUGAAAGCCAGU Cel-mir-86 UAAAGGAUCAUGGUAAAGCCAGU Cel-mir-87 UGAGAUCAUCAGUAAUAAUUCGAAACCAUAUAACAUCACCUCA Cel-mir-88 UACAAAGUAUUGCACACGGCGUGCAACCUACCCCACGU Cel-mir-89 UGAGAUCAUCAGGUGGUCCACGCGCGCGCCCACGCCCACGU Cel-mir-29 UGAUAUGUUGUAAAAGUCGU Cel-mir-29 AUAGCACCGGGUGAAUCCCCC Cel-mir-229 AUAGCACCGGGUGAAUCCCACGCGGGCCAUUCACCGGGGCCAUUCACCUAACCAUAUAACCAGUGCUCACCCCCCCC			
Cel-mir-72			
Cel-miR-73 UGGCAAGAUGUAGGCAGUUCAG CUGAACUGCUACAUCUUGCCA Cel-miR-75 UUAAAGCUACCAACCGGCUUCA UGUAGACUGCCAUUUCUUGCCA UGUAGACUGCCAUUUCUUGCCA UUAAAGCUACCAACCGGCUUCA UGUAGACUGCCAUUUCUUGCCA UGAAGCGGUUGAUAGAGCCAACCGAA UCAAGCGUUCAACCAACCAA UGUAAGCUUCAACAACCAA CEl-miR-76 UUCAUUGUUGAGAGCCUUGA UCAAGCGUUCAUCAACAACCAA CEl-miR-78 UGGAGGCUGGUUGAUGAGAGCCUUGA AGCACAAACAACAACAACAACCACGGCCUCCA AGCUUCABCUGUUAU GUGAGACCAAACCAACGACCUCCAACCEl-miR-79 AUAAAGCUAGAUUCUGAAC GUUCAGAAACCAACGACCUCCAACCEl-miR-80 UGAGAUCAUUAGAUUCUGAAC GUUCAGAAUCAUGUCGAAAGCU AGCUUUCAACUAACUACCCCEl-miR-81 UGAGAUCAUUAGUUGAAAGCCAGU ACCUUUCAACUAACUACCCCCI-miR-82 UGAGAUCAUUAGUUGAAAGCCAGU ACUAGCUUUCACGAUGUCCAACCCI-miR-83 UAGCACCAUAUAAAUUCAGUAAU UUACCGAUGUCCACACCCI-miR-83 UAAGCACCAUAUAAAAUUCAGUAAU UUACUGAAUUUAACGAUGUCCAACCCI-miR-85 UACAAAGUAUUCAGAAUCAU ACUAGCUUUCACGAUGAUCCCACCI-miR-85 UACAAAGUAUUCAGAAGCAU ACUAGCUUUCAACAUACUUUGUA ACUAGUUCACGAUGAUCCCCCI-miR-85 UACAAAGUAUUCAGAAGCAU ACUAGUUUCAAAUACUUUGUA ACUI-miR-87 GUGAGCAAAGUUUCAGAUGUCCCACGU ACCGCCUUUCAAACUAUCCCCCCCI-miR-87 GUGAGCAAAGUUUCAGGUUGC GCACACCCCUAAACCUUGCCCACGU ACCGCCUUUCAAACAACAUAUCCCCI-miR-87 GUGAGCAAGGUUUCAGGUUGC GCACACCCCGAACCUUCACCCCCCGCCCUAACCUUCACCCGCGUGCCUUA AAGGCAUUCACACGCGUGCCUUA CEl-miR-230 UUAUAGUUGUUGAAAUCCCCGCGGGCAUUCAAACAACAUAUCCCCI-miR-228 AAUGGCACGGUGAAUCCCGGGGGCAUUCACACGGCGCUUACCCCCCGGCCUUAACCGGUGCCUUACCCGCGUGCCUUAACCGGGUGCCUUAACACCGGCGCUUAACCGGGCGCUUAACCGGCGCCUCACCCI-miR-231 UAAGCUCGUAACCGGGGGAACCCGGGGGCACCACGGAGCCICACACCCCCCCGGCCCUAACCCCCCCGGCCCUAACCCCCCCGGCCCUAACCCCCCCGGCCCUAACCCCCCCGGCCCCAACCUUCACCGGCGGAAACCCCCCCC			CGUUCACUACCCAUGUCUUUCA
Ce1 - miR - 74 UGGCAAGAAAUGGCAGUCUACA UGUAAGCUGCCAUUUCUUGCCA Ce1 - miR - 75 UUAAAGCUACCAACCGGCUUCA UGAAGCCGGUUGGUACA Ce1 - miR - 76 UUCAUUGUUGUUGUGCA UGAAGCCGGUUGGCACAACAACAACACCAACAACACCGACCUCA Ce1 - miR - 77 UUCAUCAGGCCAUAGCUGUCCA UGGACACAACAACCAGCCUCCA Ce1 - miR - 79 AUAAAGCUAGUUUUUGUCU AGCCUAUGGCCUCCA Ce1 - miR - 81 UGAGAUCAUUGAAAGCCAG GUUCAGAACCAACAACAACCAGCCUCCA Ce1 - miR - 81 UGAGAUCAUCGUGAAAGCCAGU ACUAGCUUUCACGAUGUUCCA Ce1 - miR - 82 UGAGAUCAUCGUGAAAGCCAGU ACUAGCUUUCACGAUGAUCUCA Ce1 - miR - 84 UGAGGUAGUAGUAGUAGUAGU ACUAGCUUUCACGAUGAUCUCA Ce1 - miR - 85 UACAAGGUAUUCAGAGGUAGU ACGACUUUUCACAGUCAC Ce1 - miR - 86 UAAGUGAAGCAGU ACGACCUUCAAUACUUCACUCA Ce1 - miR - 87 GUGAGCAAAGUUUCAGAUGCU ACGACCUUCAAUACUUCACCC Ce1 - miR - 90 UGAUAUGUUGUUUGAAUACCCC GGGGCAUUCAACCGCCGUGAAUCACCCC Ce1 - miR - 228 AAUGGCACUGCAGAAUCACCC GGGGCAUUCAACCACACACACACACACACACACACACACA			CAGCUAUGCCAACAUCUUGCCU
Cel-miR-75 Cel-miR-75 Cel-miR-76 Cel-miR-77 UUCAUCAGGCCAUAGCUGGUUCA Cel-miR-78 UUGAGGCCUGGUUGUUGUUCA Cel-miR-78 UUGAGGCCUGGUUGUUUGUGCU Cel-miR-79 AUAAAGCUAGCCAUAGCUGCCA Cel-miR-79 AUAAAGCUAGCCAUAGCUGCCA Cel-miR-79 AUAAAGCUAGCCAUAGCUGCCA Cel-miR-79 AUAAAGCUAGCCAUAGCUGCCA Cel-miR-80 UGAGACCAGAAACAACCAGGCCUCCA Cel-miR-81 UGAGAUCAUGUGAAAGCUAG Cel-miR-82 UGAGAUCAUGGUAAAGCUAGU Cel-miR-82 UGAGAUCAUCGAAAGCUAGU Cel-miR-84 UGAGAUCAUCGUAAAGCUAGU Cel-miR-85 UACCAAAAAAUAAUAGUUGAAAGCCAGU Cel-miR-85 UACCAAAAAAUAAUAGUCGAAAGCUAGU Cel-miR-85 UACAAAGUAUGUGAAAGCCAGU Cel-miR-85 UACAAAGUAUUGUGAAAGCCAGU Cel-miR-86 UGAGGUAGUAAUAGUUGAAAGCCAGU Cel-miR-87 GUGAGCCAUAUAAAAUCCAGAUGAUUCCA Cel-miR-87 GUGAGCAAAAAGUAUUGUAAAUAUUGUA Cel-miR-87 GUGAGCAAAGUAUUCCAAGU Cel-miR-87 GUGAGCAAAGUAUUCCAAGU Cel-miR-90 UGAUAUGUUGUAAAGUCCCC GGGCAUUCAAACAACAUAUCA Cel-miR-228 AAUGGCACGCGGUGAAUCCCC Cel-miR-228 AAUGGCACGCGGUGAAUCCCC Cel-miR-228 AAUGGCACGCGGUGAAUCCAC Cel-miR-228 AAUGGCACGCGGUGAAUCCCC Cel-miR-230 GUAUUAGUUGUUCUUCCAC Cel-miR-231 UAAGCUCGUGAACACAGGAG Cel-miR-232 UAAAUGCAUUUCCAACAGGAG Cel-miR-233 UUGAGCAUGAGUAUCUUCC Cel-miR-233 UUGAGCAAUGAUCACACAGGAG Cel-miR-234 UUAUUGCUGAGAACACAUAAUCA Cel-miR-235 UAAAUGCAUCUUCCCCGGCUGA Cel-miR-236 UAAAUGCAUCUUCCCCGGCUGA Cel-miR-237 UUAAGCACGUGUUCCACAGGAG Cel-miR-238 UUUGACAACACACAUAAUCAC Cel-miR-239 UUAAACUGUCCCCAAACACAACACAAUAAUCAC Cel-miR-239 UUAAACUGUCCCCCAGGAG CCCCGCACAUGCGCAAUCACACAGGAG Cel-miR-239 UUAAACUGUCCCCCAGGCCUUU AAAGGGUAUCACCGCGUUAACCUUCCACACCCCCUUAACCACAGCAACAACAACAACACAAUAACCCICCAGGAC Cel-miR-238 UUUGACAACACAUAACCAUAACACCACAACACACAACACAACACAACA			CUGAACUGCCUACAUCUUGCCA
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Cel - miR - 77 UUCAUCAGGCCAUAGCUGUCCA UGGACGCCUGGUUGUUGUGCU AGCACAACACAGGCCUGAUAGCUCCA Cel - miR - 78 UGGAGGCCUGGUUGUUGUGUC AGCACAACACAGGCCUCCA Cel - miR - 79 AUAAAGCUAGGUUACCAAAGCU AGCUUUGGUAACCUAGUUUAU Cel - miR - 80 UGAGAUCAUUGGAAAGCUAGU GUUCAGAAUCAUAGUAUCCA Cel - miR - 81 UGAGAUCAUCGUGAAAGCUAGU ACUAGCUUUCACGAUGAUCCA Cel - miR - 82 UGAGAUCAUCGUGAAAGCCAGU ACUAGCUUUCACGAUGAUCUCA Cel - miR - 83 UAGCACCAUAUAAAUUCAGUAA UUCACGAAUUAUUAUAUGUGUCCA Cel - miR - 84 UGAGAUCAUUCUAAUAUUCAGUAA UUCACGAAUAUUAUAUAUGUGUCUA Cel - miR - 85 UAACAAGUUUUCAAGUUGU ACGACCUUUACACGAUAUACUUUACCCACGU Cel - miR - 86 UAAGUGAAAGUUUCAGGUGC GCACACCUGAAACUUUACCCCCACGU Cel - miR - 87 GUGAGCAAAGUUUCAGGUGCCAC GCACACCUGAAACCUUUAACCGCCCCCCCCCCCCCCCCC		UUAAAGCUACCAACCGGCUUCA	
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Cel-mix-78 UGGAGGCCUGGUIGUUUGUGUCU AGCACAACACCAGGCCUCCA Cel-mix-27 AUAAAGCUAGGUUACAAAGCU AGCUUUGAACCUAGCUUUAU Cel-mix-80 UGAGAUCAUUGUUGAAGC GUUCCAGAAUCAUUAUUGAACC Cel-mix-81 UGAGAUCAUUGGUGAAAGCUAGU ACUUUCACCAUAAUAAUUCACUCA Cel-mix-82 UGAGAUCAUCGUGAAAGCCAGU ACUUGCUUUCACGAUGAUCUCA Cel-mix-83 UAGCACCAUAUAAAAUUCAGUAA UUACUGAAUUUAAUAUUGUA Cel-mix-85 UACAAAGUAUUCAAAUUUGUAA UUACAAAAUUUCAAUACUACCUCA Cel-mix-86 UAAGUGAUGUUUGCCACAGU ACUGUGGAAAGCUUUCCACUCA Cel-mix-87 GUGAGCAAAGGUUUCACCAGU ACUGUGAAAGCUUUCACUUA Cel-mix-87 GUGAGCAAAGGUUUCACCAGU ACUGUUCAAAUACUUCUUCA Cel-mix-90 UGAUAUGUUUGAAUGCCCC GGGGCAUUCAAAACAUAUUCCCCC Cel-mix-228 AAUGGCACUGCAUGAAUUCCCCC GUGGCAUUCAACAGGUUCACCCC Cel-mix-229 AAUGGCACUGAUGAAUCCUUACCGCGGUGCCUUA GUGCCAUUACCCGCGUGCCUUA Cel-mix-231 UAAGUCGUACACAGGCG CUCCUGGUCGCACAACUAAUAC Cel-mix-232 UAAAUGCUUCACAGGAGC CUCCUGGUCGCACAACUAAUAC Cel-mix-233 UUAGCACUCCCCGCCCUGA CCCCCAGGUUAGCAUUCCCCAACCAUACCACACACACACA			
Cel-mir-227 AGCUUUGAACAAAGCU Cel-mir-80 UGAGAUCAUGAUGAAGCU Cel-mir-80 UGAGAUCAUGAUGAAAGCU Cel-mir-81 UGAGAUCAUGAAAGCUAGUUUGAAACCUAGUAUGAAAGCU Cel-mir-82 UGAGAUCAUGUGAAAGCUAGU Cel-mir-83 UAGCACCAUAUAAUUCGAAAGCUAGU Cel-mir-84 UGAGGAUCAUCGUGAAAGCUAGU Cel-mir-85 UACAAAGUAUUUGAAAUAUUGUA Cel-mir-85 UACAAAGUAUUUGAAAGUAGU Cel-mir-86 UAAGUGAUGAUGAAUAUUGUA Cel-mir-87 GUGAGCAAGUUUGCCACAGU Cel-mir-87 GUGAGCAAGUUUCACGGUGAAGCCAGU Cel-mir-90 UGAUUGUUUGCCACAGU Cel-mir-124 UAAGGCACGGGGGAAGCCAGU Cel-mir-228 AAUGGCACUGAAAGUUUUACCGAUGAUCACUAC Cel-mir-229 AAUGACACAGGAGCAGGCGGGGAAAAGUUUACCGCACAGU Cel-mir-221 UAAGCCACGGGGAGAGCCAGGGCCAGGAGCACACGAGUAACACAUAUCACCUCA Cel-mir-231 UAAGCUCGGAACACGGGGCCAGGGCCUUAACCGCAGUUCACCGAGCAACGUUACACGAGCAUAACACAUAUCACCICA Cel-mir-232 UAAAGCACGGGAGAGCCGGGGCACACCUGAAACUUUCCCCGACCACCUGAAACUUUCCCCGACCACCUGAAACUUUCCCCGACCACCUGAAACUUUCCCCGACACCUGAAACUUUCCCCGACACCUGAAACUUUCCCCGACACCUGAAACCUUACACACAGACCACCGCGGCCCUUA Cel-mir-228 AAUGGCACUGCACAGGAG CUCCUGGAGUACACACAUAUCACCGCCGCGCCUUA Cel-mir-231 UAAGCCACGCAGGAG CUCCUGGGCGCACAACCAAUACCCCIC-mir-232 UAAAUGCACCGCAUGACCGGGGCCUUA Cel-mir-233 UUAAGCAACAGGCAG CUCCCUGUUGAUCACGACCUUA Cel-mir-234 UUAUUGCUCGAGCAAUGCCCUUU AAAGGGUAUUCCCCAGCCCUGA Cel-mir-235 UAAUACCUCCCCGGCCCUA Cel-mir-236 UAAUACUCCCCGGCCCUGA Cel-mir-237 UCCCUGAGAAUCCCCCGCGCCGGGGAGAGUGCAAUA Cel-mir-238 UUUGUACCACAAAAGUACCC Cel-mir-239 UUUGUACCACAAAAGUACCU Cel-mir-239 UUUGUACCACAAAAGUACCU Cel-mir-241 UGAGGUAGGCACACGC GCGGGAGAGUGCAAAA Cel-mir-242 UUCCCCGGGCCGAAAACCACGC GCGCGAGAAAUACCCUAACAAAACCCICAAAACCAAAAGUACCU Cel-mir-244 UCCUUGGCCCCCGCGCGGAAAACCCCCACACCAAACCAA			AGCACAAACAACCAGGCCUCCA
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Cel-mir-80 Cel-mir-81 UGAGAUCAUUAGUUGAAAGCUAGU Cel-mir-82 UGAGAUCAUCGUGAAAGCUAGU Cel-mir-83 UAGCACCAUAUAAAUUCAGUAA Cel-mir-83 UAGCACCAUAUAAAUUCAGUAA Cel-mir-85 UACAAAGUAUUGAAAGCCAGU Cel-mir-85 UACAAAGUAUUGAAAGCCAGU Cel-mir-86 Cel-mir-87 Cel-mir-87 Cel-mir-87 UACAAAGUAUUGAAAAGUCGU Cel-mir-87 Cel-mir-87 Cel-mir-88 UAAGGACAUUUGCACAGGU Cel-mir-87 Cel-mir-89 UACAAAGUUUUGAAAAGUCGU Cel-mir-90 UGAUAUGUUUUGAGGUGGG Cel-mir-124 UAAGGCACCGGGGGAAAGCAUUCACUUA Cel-mir-124 Cel-mir-229 AAUGACACUGGUUUUCAGGUGGC Cel-mir-230 Cel-mir-231 Cel-mir-232 Cel-mir-232 UAAAUGCAUCUUAACUGGGGG Cel-mir-233 UUGAGCAAUCUUAACUGGGGG Cel-mir-234 Cel-mir-235 Cel-mir-235 UAUUGCCGAGAAUACCUUU Cel-mir-236 Cel-mir-237 Cel-mir-237 Cel-mir-238 Cel-mir-238 Cel-mir-239 UUUGUACCGAGAAUCCCCGGGGGAAGCAUUAACCCGACCUUAACACACAUAAC Cel-mir-239 Cel-mir-239 Cel-mir-239 Cel-mir-239 Cel-mir-240 Cel-mir-240 Cel-mir-241 UGAGGAAGAGUCUCGACAAGCACCCC Cel-mir-244 UCUUUGGUGAGACAAGACC Cel-mir-247 Cel-mir-247 UGACAGAGCUUUUCCCCGAGACCC Cel-mir-247 UACAGCCCCCAAAUCUUCAACACACCCCC CACACUUUUGACCACACCUUCAA Cel-mir-244 UCUUUGGUGACCACAAGCC Cel-mir-244 UCUUUGGUGACCCCCAAGACCUUCCAAACCUUUCAACACACCAAACAUAAAACAUAAAACAUAAAACAUAACAAAAACAUAAAACAUAACAAAAACAUAAACAAAAACAUAACAAAAACAUAACAAAAACAUAACAAAAACAUAAACACAAAAAA			
Cel-mir-81 UGAGAUCAUCGUGAAAGCCAGU ACUAGCUUUCACGAUGAUCUCA Cel-mir-82 UGAGAUCAUCGUGAAAGCCAGU ACUGGCUUUCACGAUGAUCUCA Cel-mir-83 UAGCACCAUAUAAAUUCAGUAA UUACUGAAUUUUAUAUGGGUCUA Cel-mir-85 UACAAAGUAUUUGAAAAGUCGU ACGACUUUUCAAAUACUUACCUCA Cel-mir-87 GUGAGCAAAGUUUCAGGUGG GCACACCUGAAACUUUCACUUA Cel-mir-87 GUGAGCAAAGUUUCAGGUGG GCACACCUGAAACUUUCACUUA Cel-mir-890 UGAUAUGUUGUUUGAAGCCCC GGGGCAUUCAACCGCGUGCCUUA Cel-mir-124 UAAGGACCGGGUGAAUUCACG GUGGCAUUCACCGCGUGCCUUA Cel-mir-228 AAUGGCACUGCAUGAAUUCACG GUGGCAUUCACCGCGUGCCUUA Cel-mir-229 AAUGACACUGGUUAUCCUUUUCC GGAAAAGAUAACCAGUGCAUU Cel-mir-231 UAAGCUCUGACAACAGGCAG CUCCUGGUCGACAACUAAUAC Cel-mir-233 UGAGCAAUGCGCAUGUGCGGG CUGCCUGUUGAUCAACAGGAGC Cel-mir-234 UUAUUGCUCGAGAAUACCCUUU AAAGGGUAUUCUCGAGAAUUCUCGAGCAGUA Cel-mir-235 UAAUACCUGUCCCCGGCCUGA UCAGGCCGGGGGAGAGUCCAAUA Cel-mir-236 UAAUACUGUCAGGUAAUACCUCAA UCAGGCCGGGGGAGAAUACAAA Cel-mir-239a UUUGUACUACACAUAGGUACCG CCGGCAAGAUUCGAGACUUCAGACAAAAGCC <td></td> <td>UGAGAUCAUUAGUUGAAAGCCG</td> <td></td>		UGAGAUCAUUAGUUGAAAGCCG	
Cel-mir-82 UGAGAUCAUCGUGAAAGCCAGU Cel-mir-83 UAGCACCAUAUAAAUUCAGUAA UUACAUGAUUUUAUAUGUGUCUCA Cel-mir-85 UACAAAGUAUUUGAAAAGUCGU Cel-mir-86 UAAGGUAGUUUGCCACAGU Cel-mir-87 GUGAGCAAAGUUUUCACAGUGA Cel-mir-87 GUGAGCAAAGUUUUCACAGUGC Cel-mir-90 UGAUUUUUAAAUCCUCA Cel-mir-90 UGAUUUUUAAAUCCUCA Cel-mir-124 UAAGGCAGGUGUUUACCACGUGC Cel-mir-228 AAUGGCACGGGUGAAUCCCC Cel-mir-230 GUAUUAGUUUGAAUCCACGGGCGUGAAUCCACUUA Cel-mir-231 UAAGCCCUGAUCACAGGAG Cel-mir-232 UAAAUGCAUCUUAACGGGGCGCGUGAUCACAGUCCC Cel-mir-233 UUGAGCAAGUUUCACGGGGGGCCACCAGGAG Cel-mir-234 UUAUUGCCGCGCGUGAUCACAGGGCCC Cel-mir-235 Cel-mir-235 UAUUGCACCUCCCGGCGUGAUCACAGGCCC Cel-mir-236 Cel-mir-237 UCCCUGAGAACUUUACCCUUU Cel-mir-238 Cel-mir-239 UUUGUACUCCCCCGCCUQA Cel-mir-239 UUUGUACUCACGAUGCCAUC Cel-mir-239 UUUGUACUCACGAGAGCC Cel-mir-240 Cel-mir-241 Cel-mir-242 Cel-mir-245 Cel-mir-245 Cel-mir-245 AUUGCCCCCCAAAUCUCCCCGCGCGCACAACUAAGACACACAC		UGAGAUCAUCGUGAAAGCUAGU	
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Cel-miR-84 UGAGGUAGUAGUAAUAUUGUA Cel-miR-85 UACAAAGUAUUUGAAAAGUCGU Cel-miR-86 UACAAGUAUUUGAAAAGUCGU Cel-miR-87 GUGAGCAAAGUUUUCAGGUGGC Cel-miR-90 UGAUAUGUUGUAAGUCCC Cel-miR-124 UAAGGCACGGGUGAAUGCCCC Cel-miR-228 AAUGGCACCUGAAAGUUUCAGGUGCCC Cel-miR-229 AAUGACACUGAUUCACGCCC Cel-miR-229 Cel-miR-231 Cel-miR-231 Cel-miR-232 UAAAUGCUUUAACGGCGGUGAAUGCCCC Cel-miR-233 Cel-miR-233 Cel-miR-234 Cel-miR-235 Cel-miR-235 Cel-miR-236 Cel-miR-237 Cel-miR-237 Cel-miR-238 Cel-miR-239 Cel-miR-239 Cel-miR-239 Cel-miR-239 Cel-miR-240 Cel-miR-241 Cel-miR-242 Cel-miR-242 Cel-miR-242 Cel-miR-244 Cel-miR-245 Cel-miR-245 Cel-miR-245 Cel-miR-245 Cel-miR-246 Cel-miR-247 Cel-miR-247 Cel-miR-248 Cel-mi	Cel-miR-83	UAGCACCAUAUAAAUUCAGUAA	
Cel-miR-85 UACAAAGUAUUUGAAAAGUCGU ACGACUUUUCAAAUACUUUGUA Cel-miR-86 UAAGUGAUGCUUUGCCACAGU ACUGUGGCAAAGCAUUCACUUA Cel-miR-90 UGAGCAAAGUUUUGAAAUGCCCC GeGGGCAUUCAAACAUUUGCCAC Cel-miR-124 UAAGGCACGCGGUGAAUGCCAC Cel-miR-124 UAAGGCACGCGGUGAAUUCACG Cel-miR-229 AAUGACACUGAAAUUCACG Cel-miR-230 GUAUUAGUUGUUCGCACCGGAAAACAUAUACA Cel-miR-231 UAAGCUCGUGAUCAACAGGAG Cel-miR-232 UAAAUGAUCUUUUCC Cel-miR-233 UUAAGCACGGAAUACCAGGAG Cel-miR-234 UUAUUGCCACGGAAAUACCCACAGUGCAUU Cel-miR-235 UAAUACGAAUCUUAACCGGCGCGCGCACAACUAAUAC Cel-miR-236 UAAUACGAGCACUUA Cel-miR-237 UCCCUGAGAAUACCCUUU Cel-miR-238 UUUGUACCCCGGCCUGA Cel-miR-239 UUUGUACUCCCCAGGCCUGA Cel-miR-239 UUUGUACUCCAACAGGC Cel-miR-239 UUUGUACUACACAUGCCAUUCAG Cel-miR-240 UACUGGCCCCAAUCGAAACAAAAGUACCAAAAG Cel-miR-241 UGAGGUAGGCCCCAAACCAAAAGUACCAAAACUAAAACCAAAAGUACCCUCACCCAAGUACCCUCACCCAAGCACCUAUCACCCCAAGUACCCCAACCAA	Cel-miR-84		
Cel-miR-86 UAAGUGAAUGCUUUGCACAGU Cel-miR-87 GUGAGCAAAGUUUCAGUUGC Cel-miR-90 UGAUAUGUUGUUUGAAUGCCC Cel-miR-124 UAAGGCACGGGUGAAUGCCCC GGGGCAUUCAAACAACAUAUCA Cel-miR-124 UAAGGCACGGGUGAAUCCAC Cel-miR-228 AAUGGCACUGAUAUUCACG Cel-miR-229 AAUGACACUGGUUAAUUCACG Cel-miR-231 UAAGCUCGUGAACAUUUCCC GGAAAGAAUAACCAGUGCAUU Cel-miR-231 UAAGCUCGUGAACAGGCAG Cel-miR-232 UAAAUGCACUUUAACGGGGG CCCCGCACAUGAGUUCACGACAGAG Cel-miR-233 UUGAGCAAUGCGCAUGGGG CCCCGCACAUGCGGAUUAACAGGCAU Cel-miR-234 UUAUUGCCCCGGCCUGA Cel-miR-235 UAUUGCACUCCCCGGCCUGA Cel-miR-236 UAAUACUGUCCCCGGCCUGA Cel-miR-237 Cel-miR-238 UUUGUACUCCCCGGCCUGA Cel-miR-238 UUUGUACUCCCAGAAUACC Cel-miR-239 Cel-miR-239 UUUGUACUACACAUAGGUAC Cel-miR-240 Cel-miR-241 Cel-miR-241 Cel-miR-242 Cel-miR-242 Cel-miR-244 CCel-miR-245 AUUGGCCCCCAAAUCUCCCC CCCAAUCUCCCCCCAGCUU AGAGAUUUUGGGGCCAUUCCCCCCCCCAAUCUCGC Cel-miR-244 CCel-miR-245 CCel-miR-245 AUUGGUCCCCCAAGUACGC CCGCACAUUGGGGCCAUUUGCCCAACGC CCGCACAUGCGCAUUGCCCAAACGC CCGCACAUGCGCAUUCCCAACACGC CCGCACAUGCGCAUUCCCAACACGC CCGCACAUGCGCAUUCCCAACACGC CCGCACAUGCGCAUUCCCAACGC CCGCACAUGCGCAUUCCCAACGC CCGCACAUGCGCAUUCCCAACGC CCGCACAUGCGCAUUCCCAACGC CCGCACAUGCGCAUUCCCAACGC CCGCACAUGCGCAUUCCGAACACGC CCGCACAUGCGCAUUCCCAACGC CCGCACAUGCCCAAUUCCGAG CCGCGCACAUGCCCAAUUCCCAACGC CCGCACAUGCCCAAUUCCCAACGC CCGCACAUGCCCAAAUCUCCGAG CCGCGCACAUGCCCAAAUCUCCGAG CCGCGCACAUCCCCAAAUCUCCAACGC CCGCACAUGCCCACACACAAAAGUACCC CCGCACAUGCCCACACACACACACAAAAGUACCC CCGCACAUGCCCACACACACACACACACACACACACACAC	Cel-miR-85		
Cel-miR-87 Cel-miR-90 UGAUAUGUUUGAGUUGC Cel-miR-124 UAAGGCACGCGGUGAAUGCCAC Cel-miR-124 UAAGGCACGCGGUGAAUGCCAC Cel-miR-124 UAAGGCACGCGGUGAAUUCACG Cel-miR-228 AAUGGCACUGCAUGAAUUCACG Cel-miR-229 AAUGACACUGGUUAUCUUUUCC Cel-miR-230 Cel-miR-231 UAAGCUCGUGACCAGGAG Cel-miR-232 UUAAGCACUGGUAUCACGGGUGCCUUA Cel-miR-233 UUGAGCAAUGCGAGGCAG Cel-miR-234 UUAUUGCUCGAGAAUACCCUUU Cel-miR-235 UAUUGACCAUGCGUUA Cel-miR-236 Cel-miR-236 Cel-miR-237 UCCCUGAGAAUCCUCCCCGGCCUGA Cel-miR-238 UUUGUACUCCGAUGCAUUCA Cel-miR-239 UUGUACUACACAAAGGCAG Cel-miR-239 Cel-miR-239 Cel-miR-240 Cel-miR-240 Cel-miR-241 Cel-miR-241 Cel-miR-242 Cel-miR-243 Cel-miR-243 Cel-miR-244 Cel-miR-244 Cel-miR-245 Cel-miR-245 Cel-miR-245 Cel-miR-246 Cel-miR-247 Cel-miR-247 Cel-miR-247 Cel-miR-248 Cel-miR-248 Cel-miR-248 Cel-miR-248 Cel-miR-248 Cel-miR-249 UCACAGGACUUUGGUCCUCCCGGGAGCU Cel-miR-249 Cel-miR-248 Cel-miR-249 UCACAGGACUUUCUCCUCCAAAAGUACU Cel-miR-248 Cel-miR-248 Cel-miR-248 Cel-miR-249 UCACAGGACUUUUGGUCCUCCCAAAAGGCU Cel-miR-248 Cel-miR-248 Cel-miR-248 Cel-miR-249 UCACAGGACUUUUGGUCCUCCCAAAAGGUCC Cel-miR-249 Cel-miR-248 Cel-miR-249 UCACAGGACUUUUGCUCC CGGGCAGUUCAGCACAAAAGCUCC CGCACAUUUCGCACCUACAAAAGACACCCUACCUCAAACACAAAAACAACAACAACAACAACA	Cel-miR-86		
Cel-miR-90 UGAUAUGUUGUUUGAAUGCCCC Cel-miR-124 UAAGGCACGCGUUGAAUUCACC Cel-miR-228 AAUGGCACUGCAUGAAUUCACC Cel-miR-229 AAUGACACUGGUUAUUUUUCC Cel-miR-230 GUAUUAGUUGUGGACCAGGAG Cel-miR-231 UAAGCUCGUGAUUCACCGAGGAG Cel-miR-233 UUAGGCACUUAACAGGCAG Cel-miR-233 UUAAGCACUGUGUUUAACUGCGGG Cel-miR-233 UUGAGCAUUCACGGGGG CCCCCACAUUAAGAUCACCGAGCUUA Cel-miR-233 UUGAGCAUUCACGGGGG CCCCCACAUGCAGCAUUUAACUGCGGGG CCCCCACAUGCCAGAGC Cel-miR-234 UUAUUGCUCCAGGAAUACCCUUU Cel-miR-235 UAUUGCACUCUCCCCGGCCUGA Cel-miR-236 UAAUACUGUCAGGAAAAGCCCAUUG Cel-miR-237 UCCCUGAGAAUUCUCAGCCAUCAG Cel-miR-238 UUUGUACUCCGAUGCCAUCAG Cel-miR-239a UUUGUACUCCGAUGCCAUCAG Cel-miR-239a UUUGUACUACACAAAAGUACUG Cel-miR-240 UACUGGCCCCCAAAUCUUCGCU Cel-miR-241 UGAGGUAGGUCGAGAAAUCCGAACCCUUC Cel-miR-242 Cel-miR-244 UCUUUGGUCGAGAAAUCUUCGAG Cel-miR-244 UCGCGAGAUUCUCGCCGCCUCCAAGUACCGC CCCCACAUACCCACCUACCCCAGCCACUACCCAGCCACUACCCCAGCCACUACCCCAAACCAAAAGUACCC Cel-miR-244 UCUUUGGUUGACUACACAAAAGUACCC Cel-miR-244 UCUUUGGUUGACCACAAAAGUACCC Cel-miR-244 UCUUUGGUUGACCACAAAAGUACCC Cel-miR-244 UCUUUGGUUGACCACAAAAGUACCC Cel-miR-244 UCUUUGGUUGACCACAAAAGUACCC Cel-miR-244 UCUUUGGUUGACCACAAAAGUGCUC Cel-miR-244 UCUUUGGUUGACCACAAAAGUGCUC Cel-miR-244 UCUUUGGUUGACCACAAAAGUGCUC Cel-miR-244 UCUUUGGUUGACCACAAAAGUGCUC Cel-miR-244 UCUUUGGUUGACCACAAAAGUGCUC Cel-miR-244 UCUUUGGUUGACCACACAAAAGUGGUA Cel-miR-244 UCUUUGGUUGACCAAAACUACCCAAAAAGUGGUA Cel-miR-244 UCUUUGGUUGACCACACAAAAGUGGUA Cel-miR-245 AUUGCCCCCCCCCCCAAAUCUUCUCUCU AGAACACACACAAAGACCCAAACACACAAAGACACAAAAGACACAAAAGACCCAAAACACACAAAAGACCCAAAAACACACAAAAGAC	Cel-miR-87		
Cel-mir-124 UAAGGCACGCGGUGAAUGCCAC Cel-mir-228 AAUGGCACUGCAUGAUGAUUCACG Cel-mir-229 AAUGACACUGGUUAUCUUUUCC Cel-mir-230 GUAUUAGUUGUGGGACCAGGAG Cel-mir-231 UAAGCUCGUGAUCAACAGGCAG Cel-mir-232 UAAAUGCAUUUAACUGCGGUG Cel-mir-233 UUGAGCACUGGAAUACCCUUU Cel-mir-233 UUGAGCAAUGCGCAUGGGGG CCCGCACAUGCGCAUUAACACGGCGG Cel-mir-234 UUAUUGCUCGAGAAUACCCUUU Cel-mir-235 UAUUGCACUCUCCCGGGCCUGA Cel-mir-236 UAAUACUGCGGUAACACGC Cel-mir-237 UCCCUGAGAAUACCCUUU Cel-mir-238 UUUGACUCUCCCGGCCUGA Cel-mir-239 UUUGUACUACACAGGCAG Cel-mir-239 UUUGUACUACACAUGCGCAUUCAG Cel-mir-239 UUUGUACUACACAUAGGUACU Cel-mir-240 UACUGGCCCCAAAUCUUCGC Cel-mir-241 UGAGGUAGGUGCGAAUACCCU Cel-mir-242 UUGCGUAGGCAAUACCCU Cel-mir-244 UCUUUGGUCGGGGGAAAUACC Cel-mir-245 CGGUACGCCAAAUCUUCGAC Cel-mir-244 UCUUUGGUCGGGGGGAAUACC Cel-mir-244 UCUUUGGUUGUUCGAG Cel-mir-244 UCUUUGGUUGUUCGAG Cel-mir-244 UCUUUGGUUGUUCGAGCACAUACCCGACCCACACCCCACCCCACACCCCACCCA	Cel-miR-90		
Cel-mir-228 Cel-mir-229 Cel-mir-230 Cel-mir-230 Cel-mir-231 Cel-mir-231 Cel-mir-231 Cel-mir-232 Cel-mir-232 Cel-mir-233 Cel-mir-233 Cel-mir-233 Cel-mir-234 Cel-mir-235 Cel-mir-235 Cel-mir-236 Cel-mir-236 Cel-mir-237 Cel-mir-237 Cel-mir-238 Cel-mir-238 Cel-mir-238 Cel-mir-239 Cel-mir-239 Cel-mir-239 Cel-mir-236 Cel-mir-237 Cel-mir-237 Cel-mir-238 Cel-mir-238 Cel-mir-239 Cel-mir-239 Cel-mir-239 Cel-mir-239 Cel-mir-239 Cel-mir-240 Cel-mir-240 Cel-mir-241 Cel-mir-241 Cel-mir-242 Cel-mir-242 Cel-mir-243 Cel-mir-244 Cel-mir-244 Cel-mir-245 Cel-mir-245 Cel-mir-244 Cel-mir-245 Cel-mir-244 Cel-mir-244 Cel-mir-245 Cel-mir-245 Cel-mir-246 Cel-mir-246 Cel-mir-246 Cel-mir-247 Cel-mir-248 Cel-mir-249 Cel-mir-249 Cel-mir-249 Cel-mir-249 Cel-mir-249 Cel-mir-249 Cel-mir-248 Cel-mir-249 Cel-mir-249 Cel-mir-249 Cel-mir-249 Cel-mir-249 Cel-mir-249 Cel-mir-249 Cel-mir-246 Cel-mir-246 Cel-mir-247 Cel-mir-248 Cel-mir-248 Cel-mir-249 Cel-mi	Cel-miR-124		
Cel-mir-229 Cel-mir-230 Cel-mir-231 Cel-mir-231 Cel-mir-232 Cel-mir-232 Cel-mir-232 Cel-mir-233 Cel-mir-233 Cel-mir-234 Cel-mir-234 Cel-mir-235 Cel-mir-235 Cel-mir-235 Cel-mir-236 Cel-mir-237 Cel-mir-237 Cel-mir-237 Cel-mir-238 Cel-mir-239 Cel-mir-239 Cel-mir-239 Cel-mir-237 Cel-mir-238 Cel-mir-239 Cel-mir-238 Cel-mir-239 Cel-mir-239 Cel-mir-239 Cel-mir-239 Cel-mir-240 Cel-mir-241 Cel-mir-241 Cel-mir-242 Cel-mir-242 Cel-mir-242 Cel-mir-243 Cel-mir-243 Cel-mir-244 Cel-mir-244 Cel-mir-245 Cel-mir-245 Cel-mir-245 Cel-mir-246 Cel-mir-247 Cel-mir-248 Cel-mir-248 Cel-mir-249 Cel-mir-248 Cel-mir-249 Cel-mi	Cel-miR-228		
Cel-mir-230 Cel-mir-231 UAAGCUCGUGAUCAACAGGCAG Cel-mir-232 UAAAUGCAUCUUAACUGCGGUG Cel-mir-233 UUGAGCAUGUUGAGCAGGCAG Cel-mir-234 UUAUUGCUCGAGAAUACCCUUU Cel-mir-235 Cel-mir-235 UAUUGCAUCUUCCCCGGGCUGA Cel-mir-236 Cel-mir-237 UCCCUGAGAAUUCUCCCCGGGCCUGA Cel-mir-238 UUUGUACUAGGAAUUCUCGAACAGC Cel-mir-239 Cel-mir-239a UUUGUACUACACAUAGGUACUG Cel-mir-239a Cel-mir-239b UUUGUACUACACAUAGGUACUG Cel-mir-240 Cel-mir-241 Cel-mir-242 Cel-mir-243 Cel-mir-243 Cel-mir-243 Cel-mir-244 Cel-mir-245 Cel-mir-245 Cel-mir-245 Cel-mir-246 Cel-mir-246 Cel-mir-246 Cel-mir-247 Cel-mir-247 Cel-mir-248 Cel-mir-248 Cel-mir-249 UACACGGACUAUUCGGAGACGC CACCGCACAUUGACCUCAACACGC CGCGCACAUUCAGGAAUUCUCGAACAGC CCGCACAUUCAGGAAUUCUCGAACAGC CCGCACAUUCAGGAAUUCUCGAACAGC CCGCACAUUCAGGAAUUCUCGAACAGC CCGCACAUUCCGAAGAGAUUCUCAGAGAAUUCUCAGGGAACAUCUCAGGAAAUCUCCAGAAAAGUACUG CAGUACUUUUGUUAGUACAAAA CAAAAAGGACCUAUUUUGUUAGGAGCCU AGCGAAGAUUUGGGGGCCAGUA CCCL-MIR-244 CCGUACGUACGCCCCAAAUCUUCGAAGACAGC CCCGAAGAAGAGCCUAUCUCGAAGACACAAAAGAACACCAAAAGAACACCAC	Cel-miR-229		
Cel-mir-231 UAAGCUCGUGAUCAACAGGCAG CUGCCUGUUGAUCACGAGCUUA Cel-mir-232 UAAAUGCAUCUUAACUGCGGUG CACCGCAGUUAAGAUGCAUUUA Cel-mir-233 UUGAGCAAUGCGCAUGUGCGGG CCCGCACAUGCGCAUUGCUCAA Cel-mir-234 UUAUUGCUCGAGAAUACCCUUU AAAGGGUAUUCUCGAGCAAUAA Cel-mir-235 UAAUACUGUCCCCGGCCUGA UCAGGCCGGGGAGAGUGCAAUA Cel-mir-236 UAAUACUGUCAGGUAAUGACC GCGUCAUUACCUGACAGUAUUA Cel-mir-237 UCCCUGAGAAUUCUCGAACAGC GCGUCAUUACCUGACAGUAUUA Cel-mir-238 UUUGUACUCCGAUGCAUCAG CUGAAUGGCAUUCAG Cel-mir-239a UUUGUACUACACAUAGGUACUG CAGUACCUAUGUGUAGAAA Cel-mir-239b UUUGUACUACACAAAAGUACUG CAGUACCUAUGUGUAGUACAAA Cel-mir-240 UACUGGCCCCCAAAUCUUCGCU AGCAGACUUUUGUGUAGGACAAA Cel-mir-241 UGAGGUAGGCGUUUGCUUCGAG Cel-mir-242 UUGCGUAGGCCUUUGCUCAAG Cel-mir-243 CGGUACGGGGGAUAU AUAUCCCGCCGCGAUCGCAA Cel-mir-244 UCUUUGGUUGUACAAAGUGGUA CUCGAAGCAAAGGCCUACCUCA Cel-mir-245 AUUGGUCCCCCCAAGUAGUC GAGCUAUUUGUACAACCAAAGA Cel-mir-245 AUUGGUCCCCUCCAAGUAGCUC GAGCUACUUGGAGAACAACACAAAGAC Cel-mir-245 UUACAUGUUUCGGGUAGAGCU AGCUCCUACCCGCAACCAAAGA Cel-mir-245 AUUGGUCCCCUCCAAGUAGCUC GAGCUACUUGGAGGGGACCAAU Cel-mir-245 UUACAUGUUUCGGGUAGGAGCU Cel-mir-246 UUACAUGUUUCGGGUAGGAGCU Cel-mir-247 UGACUAGAGCCUAUUCUUCU AGAAGAGAAACAUGUAA Cel-mir-248 UACACGUGCAGGAUAACGCUC GAGCUUACCCGAAACAUGUAA Cel-mir-249 UCACAGGACUUUUGAGCGUUCG CACGCCGCACAUUACCCGACACAACA CACGCUCAACGCCCAAAAACACCCAAACA CACACCUUUGAACACAAAAACACAAAACACCAAACA CACACCUUUGAACCCCAAACACACAACACA	Cel-miR-230		
Cel-mir-232 UAAAUGCAUCUUAACUGCGGUG CACCGCAGUUAAGAUGCAUUUA Cel-mir-233 UUGAGCAAUGCGCAUGUGCGGG CCCGCACAUGCGCAUUGCUCAA Cel-mir-234 UUAUUGCUCGAGAAUACCCUUU AAAGGGUAUUCUCGAGCAAUAA Cel-mir-235 UAAUACUGUCCCCGGCCUGA UCAGCCGGGGGAGAGUGCAAUA Cel-mir-236 UAAUACUGUCAGGUAAUGACGC GCGUCAUUACCUGACAGUAUUA Cel-mir-237 UCCCUGAGAAUUCUCGAACAGC GCUGUUCGAGAAUUCUCAGGGA Cel-mir-238 UUUGUACUCCGAUGCCAUUCAG CUGAAUGGCAUCGAAGUACAAA Cel-mir-239a UUUGUACUACACAAAAGGUACUG CAGUACCUAUGGUAGUACAAA Cel-mir-239b UUUGUACUACACAAAAGGAC CAGUACCUAUUUGUUGUAGUACAAA Cel-mir-240 UACUGGCCCCCAAAUCUUCGCU AGCGAAGAUUUUGGGGGCCAGUA Cel-mir-241 UGAGGUAGGCCUUUGCUUCGAG Cel-mir-242 UUGCGUAGGCCUUUGCUUCGAG Cel-mir-243 CGGUACGAUCGGGGGGAUAU AUAUCCCGCCGCGCGAUCGUACCCCA Cel-mir-244 UCCUUUGGUUGAAAAGUGUA CUCGAAGCAAAGGCCUACCGCAA Cel-mir-244 UCCUUUGGUUGAAAAGUGGUA UACCACUUUGUACAAACCAAAGA Cel-mir-245 AUUGGUCCCCUCCAAGUAGCUC GAGCUACUUGGAGGGGACCAAU Cel-mir-246 UUACAUGUUCCGGUAGGAGCU Cel-mir-247 UGACUAGAGCCUAUUCUCUUCU AGAAGAGAAAAACGCUCAACCCAAACACCAAAGA Cel-mir-248 UACACGUGCACGGAUAACGCUC Cel-mir-248 UACACGUGCACGGAUAACGCUC Cel-mir-249 UCACAGGACUUUUGAGCGUCG GAGCGUUAUCCGGGCACAAAGUCCUACCCGAAACAUCUAGCCC CACCGCACACUUUAGAACCCUAGUACCC CACCGCACACUUUAACACAAAAAACGCUC CACCGCACACUUUGUACAAAAAACGCUC CACCGCACACUUUGUACAAAAACGCUC AGCUACCUCACCCGAAACACAUAAAAACACCAAAAGA CCACUUUGGAAGGACCUAUUCUCUUCU AGAAGAGAAAAAGGCCUAAUAAACGCUC CACCGCACACUUUAACACAAAAAACGCUC CACGCACACUUUGUACAAAAAACGCUC CACCGCACACAUAAAAAACACCAAAAAAAACAAAAAAAAA	Cel-miR-231		
Cel-mir-233 UUGAGCAAUGCGCAUGUGCGGG Cel-mir-234 UUAUUGCUCGAGAAUACCCUUU AAAGGGUAUUCUCGAGCAAUAA Cel-mir-235 UAUUGCACUCUCCCCGGCCUGA Cel-mir-236 UAAUACUGUCAGGUAAUGACGC Cel-mir-237 UCCCUGAGAAUUCUCGAACAGC Cel-mir-238 UUUGUACUCCGAUGCCAUUCAG Cel-mir-239a Cel-mir-239b UUUGUACUACACAUAGGUACUG Cel-mir-240 UACUGGCCCCAAAUCUUCGCU Cel-mir-241 UGAGGUAGGUCGAGAAUUCGCGACAC Cel-mir-242 Cel-mir-243 Cel-mir-243 Cel-mir-244 Cel-mir-245 Cel-mir-245 Cel-mir-245 Cel-mir-246 Cel-mir-246 Cel-mir-247 Cel-mir-248 Cel-mir-248 Cel-mir-248 Cel-mir-249 UCACGGAGACUUUCGCU AGAGCAAAGGCCUAUCGCAAACCAAAC	Cel-miR-232		
Cel-mir-234 UUAUUGCUCGAGAAUACCCUUU AAAGGGUAUUCUCGAGCAAUAA Cel-mir-235 UAUUGCACUCUCCCGGCCUGA UCAGGCCGGGGAGAGUGCAAUA Cel-mir-236 UAAUACUGUCAGGUAAUGACGC GCGUCAUUACCUGACAGUAUUA Cel-mir-237 UCCCUGAGAAUUCUCGAACAGC GCUGUUCGAGAAUUCUCAGGGA Cel-mir-238 UUUGUACUCCGAUGCCAUUCAG CUGAAUGGCACUAAA Cel-mir-239a UUUGUACUACACAUAGGUACUG CAGUACCUAUGUGUAGUACAAA Cel-mir-239b UUUGUACUACACAAAAGUACUG CAGUACCUAUGUGUAGUACAAAA Cel-mir-240 UACUGGCCCCCAAAUCUUCGCU AGCGAAGAUUUUGGGGGCCAGUA Cel-mir-241 UGAGGUAGGUCGAGAAAUGAC GUCAUUUUUGUGUAGUACAAA Cel-mir-242 UUGCGUAGGCCUUUGCUUCAAG CUCGAAGCAAAAGGCCUACCCACA Cel-mir-243 CGGUACGAUCGCGGGGGGAUAU AUAUCCCGCCGCGCAUCGUACCCCA Cel-mir-244 UCUUUGGUUGUACAAAGUGGUA AUAUCCCGCCGCGCAUCGUACCG Cel-mir-245 AUUGGUCCCCUCCAAGUAGCUC GAGCUACUUGGUACAACCAAAGA Cel-mir-246 UUACAUGUUUCGGGUAGGACCU AGCUCCUACCCCGAAACAUGUAA Cel-mir-247 UGACUAGAGCCUUAUCUCUCU AGAAGAAAUGUCA Cel-mir-248 UACACGUGCACGGAUAACGCUC GAGCGUUAUCCGCGCACGUUAUCCACCCGAAACAUGUAA Cel-mir-249 UCACAGGACUUUUGAGCGUUCG Cel-mir-249 UCACAGGACUUUUGAGCGUUCG CAGUACUUCGAGCCUCAAAGUACCC AGCCUCCUACCCGCAAACGUACAACACAAC	Cel-miR-233	UUGAGCAAUGCGCAUGUGCGGG	
Cel-mir-235 UAUUGCACUCUCCCGGCCUGA Cel-mir-236 UAAUACUGUCAGGUAAUGACGC Cel-mir-237 UCCCUGAGAAUUCUCGAACAGC Cel-mir-238 UUUGUACUCCGAUGCCAUUCAG Cel-mir-239a Cel-mir-239b UUUGUACUACACAAAAGUACUG Cel-mir-240 Cel-mir-241 UGAGGUAGGUAGGAAUUCUCGAG Cel-mir-242 Cel-mir-242 Cel-mir-243 Cel-mir-243 Cel-mir-243 Cel-mir-244 Cel-mir-245 Cel-mir-244 UCUUUGGUAGGCCCUCCAAGUAGUA Cel-mir-245 Cel-mir-245 Cel-mir-246 Cel-mir-246 Cel-mir-247 Cel-mir-248 UUACACGUGGGUAGGAGAACGCUC Cel-mir-248 UACACGUGGAGACUAUCUCGCU CAGUACCUUUGUAGGACCUACCUCA CEL-Mir-246 CEL-Mir-247 CEL-Mir-247 CEL-Mir-248 CEL-Mir-248 CEL-Mir-248 CEL-Mir-249 UCACACGUGCACGAAACGCUC CEL-Mir-249 CEL-Mir-		UUAUUGCUCGAGAAHACCCIIIII	
Cel-mir-236 Cel-mir-237 Cel-mir-237 Cel-mir-238 Cel-mir-238 Cel-mir-239a Cel-mir-239b Cel-mir-240 Cel-mir-241 Cel-mir-242 Cel-mir-243 Cel-mir-243 Cel-mir-243 Cel-mir-243 Cel-mir-244 Cel-mir-243 Cel-mir-244 Cel-mir-243 Cel-mir-244 Cel-mir-245 Cel-mir-245 Cel-mir-245 Cel-mir-246 Cel-mir-247 Cel-mir-248 Cel-mir-248 Cel-mir-249 Cel-mir-249 Cel-mir-249 Cel-mir-249 Cel-mir-248 Cel-mir-248 Cel-mir-249 Cel-mir-248 Cel-mir-249 Cel-mir-249 Cel-mir-248 Cel-mir-249 Cel-mir-249 Cel-mir-249 Cel-mir-248 Cel-mir-249 Cel-		UAUUGCACUCUCCCCGCCCTGA	
Cel-mir-237 UCCCUGAGAAUUCUCGAACAGC Cel-mir-238 UUUGUACUCCGAUGCCAUUCAG Cel-mir-239a UUUGUACUACACAAAAGUACUG Cel-mir-239b UUUGUACUACACAAAAGUACUG Cel-mir-240 UACUGGCCCCCCAAAUCUUCGCU AGCGAAGAUUUUGGGGGCCAGUA Cel-mir-241 UGAGGUAGGCCUUUGCUUCGAG CUCGAAGCAAAAGGCCUCCA Cel-mir-242 UUGCGUAGGCCUUUGCUUCGAG CUCGAAGCAAAGGCCUACCUCA Cel-mir-243 CGGUACGAUCGCGGCGGGAUAU AUAUCCCGCCGCGGAUCGUACCG Cel-mir-244 UCUUUGGUUGAAAAGUGGUA AUAUCCCGCCGCGCGAUCGUACCG Cel-mir-245 AUUGGUCCCCUCCAAGUAGCUC GAGCUACUUGGAGCCAAU Cel-mir-246 UUACAUGUUUCGGGUAGGAGCU AGCUACUUGGAGGCCAAU Cel-mir-247 UGACUAGAGCCUAUCUCUCU AGAAGAAAAAGUGCUCACCGAAACAUGUAA Cel-mir-248 UACACGUGCACGGAUAACGCUC GAGCGUUAUCCCGUGCACCUCACCU		UAAUACUGUCAGGUAAUGACCC	
Cel-miR-238 UUUGUACUCCGAUGCCAUUCAG Cel-miR-239a UUUGUACUACACAUAGGUACUG CAGUACCUAUGUGUAGUACAAA Cel-miR-239b UUUGUACUACACAAAAGUACUG Cel-miR-240 UACUGGCCCCCAAAUCUUCGCU Cel-miR-241 UGAGGUAGGUGCGAGAAAUGAC Cel-miR-242 UUGCGUAGGCCUUUGCUUCGAG Cel-miR-243 CGGUACGUUGGUUCGAG Cel-miR-244 UCUUUGGUUGAAAAGUGGUA Cel-miR-245 AUUGGUCCCCCAAGUAGUA Cel-miR-246 UUACAUGUUUCGGGUAGGAGCU Cel-miR-247 Cel-miR-247 UGACUAGGUAGGCUAUCUCUCU Cel-miR-248 UACACGUGCACGGAUAU Cel-miR-248 UACACGUGCACGGAUAUCUCUCU Cel-miR-248 UACACGUGCACGGAUAACGCUC CAGUACUUUGUAGAGCCUACCUCA CGAAGAAAAGGCCUAUUCUCUUCU AGAAGAGAAACAUGUAA CGAGCGUUAUCCGGAAACAUGUAA CGAGCGUUAUCCGGAAACAUGUAA CGAGCGUUAUCCGGAAACAUGUAA CCEl-miR-247 UGACUAGAGCCUAUUCUCUUCU CGAAGCAAAGA CGAGCUACUUGGAGGGGACCAAU ACCACUUUGGAGGGGACCAAU AGCCCUACCCGAAACAUGUAA CGAGCGUUAUCCGGGAAACAUGUAA CCEl-miR-248 UACACGUGCACGGAUAACGCUC CAGUACUUUGGAGGGCCAAACAUGUAA CACCUUUGGAGGGCCUAUUCUCUCU AGAAGAGAAAACAUGUAA CCEl-miR-248 UACACGUGCACGGAUAACGCUC GAGCGUUAUCCGUGCACGUGUA CCEl-miR-249 UCACAGGACUUUUGAGCGUUGC GCAACGCUCAAAAGUCCUGUGA			
Cel-mir-239a UUUGUACUACACAUAGGUACUG CAGUACCUAUGUGUAGUACAAA Cel-mir-240 UACUGGCCCCCAAAUCUUCGCU AGCGAAGAUUUUGUGUAGUACAAA Cel-mir-241 UGAGGUAGGUGCGAGAAAUGAC GUCAUUUUUGUGUAGUACCUCA Cel-mir-242 UUGCGUAGGCCUUUGCUUCGAG CUCGAAGAAAGGCCUACCUCA Cel-mir-243 CGGUACGAUCGCGGGGGAUAU AUAUCCCGCCGCGGAUCGUACCG Cel-mir-244 UCUUUGGUUGUACAAAGUGGUA UACCACUUUGUACAACCAAAGA Cel-mir-245 AUUGGUCCCCUCCAAGUAGCUC GAGCUACUUGGAGGGACCAAU Cel-mir-246 UUACAUGUUUCGGGUAGGACU AGCUCCUACCCGAAACAU Cel-mir-247 UGACUAGAGCCUAUUCUCUUCU AGAAGAAACAUGUAA Cel-mir-248 UACACGUGCACGGAUAACGCUC GAGCGUUAUCCGUGCACCUGUACCCGAACAUCUAGCCACCUAGCCACGUGUACCCACCUACCCGAAACAUCUAGCCACCUACCCGAAACAUCUAGCCACCUACCCGAAACAUCUAGCCACCUACCCGAAACAUCACCACACACA			
Cel-mir-249 UUUGUACUACACAAAAGUACUG CAGUACUUUUGUGUAGUACAAA Cel-mir-240 UACUGGCCCCCAAAUCUUCGCU AGCGAAGAUUUUGGGGGGCCAGUA Cel-mir-241 UGAGGUAGGUGCGAGAAAUGAC GUCAUUUCUCGCACCUACCUCA Cel-mir-242 UUGCGUAGGCCUUUGCUUCGAG CUCGAAGCAAAGGCCUACGCAA Cel-mir-243 CGGUACGAUCGCGGGGGAUAU AUAUCCCGCCGCGGAUCGUACCG Cel-mir-244 UCUUUGGUUGUACAAAGUGGUA UACCACUUUGUACAACCAAAGA Cel-mir-245 AUUGGUCCCCUCCAAGUAGCUC GAGCUACUUGGAGGGACCAAU Cel-mir-246 UUACAUGUUUCGGGUAGGAGCU AGCUCCUACCCGAAACAU Cel-mir-247 UGACUAGAGCCUAUUCUCUUCU AGAAGAAAUAGGCUCUAGUCA Cel-mir-248 UACACGUGCACGGAUAACGCUC GAGCGUUAUCCGGUGCACGUGUA Cel-mir-249 UCACAGGACUUUUGAGCGUUGC GCAACGUUCAAAAGUCCUGUGA			
Cel-mir-240 UACUGGCCCCCAAAUCUUCGCU Cel-mir-241 UGAGGUAGGUGCGAGAAAUGAC Cel-mir-242 UUGCGUAGGCCUUUGCUUCGAG Cel-mir-243 CGGUACGAUCGCGGCGGGAUAU Cel-mir-244 UCUUUGGUUGUACAAAGUGGUA Cel-mir-245 AUUGGUCCCCUCCAAGUAGCUC Cel-mir-246 UUACAUGUUUCGGGUAGGAGCU Cel-mir-247 UGACUAGGCCUACCCAAGUAGCU Cel-mir-248 UACACGUGCAGAAACGUC Cel-mir-248 UACACGUGCAGAAACGUC Cel-mir-249 UCACAGGACUUUGUGGGGACGUAC AGCGAAGAUUUGGGGGACCUAUUCUCUUCU AGAAGAGAAAUAGGCUCUAGUCA Cel-mir-249 UCACAGGACUUUUGAGCGUUGA CGACGUUACCGGAAACAUGUAA CAAAGAGAAAAAGUCCUCGAAAAAGUCCUCGAAACAUGUAA AGAAGAGAAAAAGUCCUCGAAAAAGUCCUCGAAAAAGUCCUGUGA CAAAAAAGUCCUCAAAAAGUCCAAAAAAGUCCUCAAAAAAGUCCUCAAAAAAGUCCUCGAAAAAAGUCCUCGAAAAAAGUCCUCGAAAAAAGUCCUCGAAAAAAGUCCUCGAAAAAAGUCCUCGAAAAAAGUCCUCGUGAAAAAAGUCCUCGUGAAAAAAGUCCUCGUGAAAAAAGUCCUCGUGAAAAAAGUCCUCGUGAAAAAGUCCUCGUGAAAAAAGUCCUCGUGAAAAAGUCCUCGUGAAAAAAGUCCUCGUGAAACAUCCGAAAAAGUCCUCGUGAAACAUCCGUCAAAAAGUCCUCGUGAAACAUCCGUCAAAACAUCCCGAAACAUCCCGAAACAUCCCGAAACAUCCCGAAACAUCCACACAAACAUCCACAAACAUCCCGAAACAACAUCCACACACA		ITITICITÀ CITÀ CA CA A A ACITA CITA	
Cel-mir-241 UGAGGUAGGUGCAGAAAUGAC Cel-mir-242 UUGCGUAGGCCUUUGCUUCGAA Cel-mir-243 CGGUACGAUCGCGGGGGAUAU Cel-mir-244 UCUUUGGUUGAAAAGUGGUA Cel-mir-245 AUUGGUCCCCUCCAAGUAGCUC Cel-mir-246 UUACAUGUUUCGGGUAGGAGCU Cel-mir-247 UGACUAGAGCCUAUUCUCUUCU Cel-mir-248 UACACGUGCACGGAUAACGCUC Cel-mir-249 UCACAGGACUUUUGAGCGUUGC GAGCUACUUGGAGGCGCACAAU AGAAGAGAAUAGGCUCUAGUCA GAGCGUUAUCCGGAAACAUGUAA AGAAGAGAAUAGGCUCUAGUCA GAGCGUUAUCCGGUGCACGUGUA GAACGCUCAAAAGUCCUCGAACCGUGUA GAACGCUCAAAAAGUCCUCGGAAAAAGUCCUCGGAAAAAGUCCUGUGA		IIA CIICCCCCCA A A LICITICACIA	
Cel-mir-243 UUGCGUAGGCCUUUGCUUCGAG CUCGAAGCAAAGGCCUACCUCA Cel-mir-244 CUCGAGGCGGGGGAUAU AUAUCCCGCCGCGAUCGUACCG Cel-mir-245 AUUGGUUGUACAAAGUGGUA UACCACUUUGUACAACCAAAGA Cel-mir-246 UUACAUGUUUCGGGUAGGAGCU GAGCUACCUACCGAAACAU Cel-mir-247 UGACUAGAGCCUAUUCUCUUCU AGAAGAAACAUGUAA Cel-mir-248 UACACGUGCACGGAUAACGCUC GAGCGUUAUCCGGUCAGCCCACUAGUCA Cel-mir-249 UCACAGGACUUUUGAGCGUUGC GCAACGCUCAAAAGUCCUGUGA		TICACCITA CCTTCCCA CA A ALTGA C	
Cel-miR-243 CGGUACGAUCGCGGCGGGAUAU AUAUCCCGCCGCGAUCGUACGCAA Cel-miR-244 UCUUUGGUUGUACAAAGUGGUA UACCACUUUGUACAACCAAAGA Cel-miR-245 AUUGGUCCCCUCCAAGUAGCUC GAGCUACUUGGAGGGGACCAAU Cel-miR-246 UUACAUGUUUCGGGUAGGAGCU AGCUCCUACCCGAAACAUGUAA Cel-miR-247 UGACUAGAGCCUAUUCUCUUCU AGAAGAGAAUAGGCUCUAGUCA Cel-miR-248 UACACGUGCACGGAUAACGCUC GAGCGUUAUCCGUGCACGUGUA Cel-miR-249 UCACAGGACUUUUGAGCGUUGC GCAACGCUCAAAAGUCCUGUGA		ITICCCIIA CCCCITTUCCITTACA	GUCAUUUCUCGCACCUACCUCA
Cel-mir-244 UCUUUGGUUGUACAAAGUGGUA UACCACUUUGUACAACCAAAGA Cel-mir-245 AUUGGUCCCCUCCAAGUAGCUC GAGCUACUUGGAGGGGACCAAU Cel-mir-246 UUACAUGUUUCGGGUAGGAGCU AGCUCCUACCCGAAACAUGUAA Cel-mir-247 UGACUAGAGCCUAUUCUCUUCU AGAAGAGAAUAGGCUCUAGUCA Cel-mir-248 UACACGUGCACGGAUAACGCUC GAGCGUUAUCCGUGCACGUGUA Cel-mir-249 UCACAGGACUUUUGAGCGUUGC GCAACGCUCAAAAGUCCUGUGA		CGGIIA CGAIICCGGGGGGGAIIAIT	CUCGAAGCAAAGGCCUACGCAA
Cel-miR-245 AUUGGUCCCCUCCAAGUAGCUC GAGCUACUUGGAGGGACCAAU Cel-miR-246 UUACAUGUUUCGGGUAGGAGCU AGCUCCUACCCGAAACAU Cel-miR-247 UGACUAGAGCCUAUUCUCUUCU AGAAGAAAUAGGCUCUAGUCA Cel-miR-248 UACACGUGCACGGAUAACGCUC GAGCGUUAUCCGUGCACGUGUA Cel-miR-249 UCACAGGACUUUUGAGCGUUGC GCAACGCUCAAAAGUCCUGUGA		TICITUICCITICITA CA A CITICATE	AUAUCCCGCCGCGAUCGUACCG
Cel-miR-246 UUACAUGUUUCGGGUAGGAGCU AGCUCCUACCCGAAACAUGUAA Cel-miR-247 UGACUAGAGCCUAUUCUUCU AGAAGAGAAUAGGCUCUAGUCA Cel-miR-248 UACACGUGCACGGAUAACGCUC GAGCGUUAUCCGUGCACGUGUA Cel-miR-249 UCACAGGACUUUUGAGCGUUGC GCAACGCUCAAAAGUCCUGUGA		AUTICCUCCCCTICCA ACTA	UACCACUUUGUACAACCAAAGA
Cel-mir-247 UGACUAGAGCCUAUUCUUCU AGAAGAGAAUAGGCUCUAGUCA Cel-mir-248 UACACGUGCACGGAUAACGCUC GAGCGUUAUCCGUGCACGUGUA Cel-mir-249 UCACAGGACUUUUGAGCGUUGC GCAACGCUCAAAAGUCCUGUGA		ITTA CATICITATIOGGGTTA GGA CG	GAGCUACUUGGAGGGGACCAAU
Cel-mir-248 UACACGUGCACGGAUAACGCUC GAGCGUUAUCCGUGCACGUGUA Cel-mir-249 UCACAGGACUUUUGAGCGUUGC GCAACGCUCAAAAGUCCUGUGA		IICA CIIA CA COCITA IIIICA	
Cel-miR-249 UCACAGGACUUUUGAGCGUUGC GCAACGCUCAAAAGUCCUGUGA		IIA CA COLICCA COCATTA A COCATTA	AGAAGAGAAUAGGCUCUAGUCA
GCAACGCOCAAAAGUCCUGUGA		IICACACGUGCACGAUAACGCUC	GAGCGUUAUCCGUGCACGUGUA
CCAUGCCAACAGUCAACUGUUGGCAUGG CCAUGCCAACAGUUGACUGUGA		IICA CA CIICA A CIICTETCA CO	GCAACGCUCAAAAGUCCUGUGA
		CACAGUCAACUGUUGGCAUGG	CCAUGCCAACAGUUGACUGUGA

microRNA name	microRNA sequence	Anti-microRNA molecule
	(5' to 3')	sequence (5' to 3')
Cel-miR-251	UUAAGUAGUGGUGCCGCUCUUA	UAAGAGCGGCACCACUACUUAA
Cel-miR-252	UAAGUAGUAGUGCCGCAGGUAA	UUACCUGCGGCACUACUUA
Cel-miR-253	CACACCUCACUAACACUGACCA	UGGUCAGUGUUAGUGAGGUGUG
Cel-miR-254	UGCAAAUCUUUCGCGACUGUAG	CUACAGUCGCGAAAGAUUUGCA
Cel-miR-256	UGGAAUGCAUAGAAGACUGUAC	GUACAGUCUUCUAUGCAUUCCA
Cel-miR-257	GAGUAUCAGGAGUACCCAGUGA	UCACUGGGUACUCCUGAUACUC
Cel-miR-258	GGUUUUGAGAGGAAUCCUUUUA	UAAAAGGAUUCCUCUCAAAACC
Cel-miR-259	AGUAAAUCUCAUCCUAAUCUGG	CCAGAUUAGGAUGAGAUUUACU
Cel-miR-260	GUGAUGUCGAACUCUUGUAGGA	UCCUACAAGAGUUCGACAUCAC
Cel-miR-261	UAGCUUUUUAGUUUUUCACGGUG	CACCGUGAAAACUAAAAAGCUA
Cel-miR-262	GUUUCUCGAUGUUUUCUGAUAC	GUAUCAGAAAACAUCGAGAAAC
Cel-miR-264	GGCGGGUGGUUGUUAUGGG	CCCAUAACAACCACCCGCC
Cel-miR-265	UGAGGGAGGAAGGGUGGUAUUU	AAAUACCACCCUUCCUCCCUCA
Cel-miR-266	AGGCAAGACUUUGGCAAAGCUU	AAGCUUUGCCAAAGUCUUGCCU
Cel-miR-267	CCCGUGAAGUGUCUGCUGCAAU	AUUGCAGCAGACACUUCACGGG
Cel-miR-268	GGCAAGAAUUAGAAGCAGUUUG	CAAACUGCUUCUAAUUCUUGCC
Cel-miR-269	GGCAAGACUCUGGCAAAACUUG	CAAGUUUUGCCAGAGUCUUGCC
Cel-miR-270	GGCAUGAUGUAGCAGUGGAGAU	AUCUCCACUGCUACAUCAUGCC
Cel-miR-271	UCGCCGGGUGGGAAAGCAUUCG	CGAAUGCUŲUCCCACCCGGCGA
Cel-miR-272	UGUAGGCAUGGGUGUUUGGAAG	CUUCCAAACACCCAUGCCUACA
Cel-miR-273	UGCCCGUACUGUGUCGGCUGCU	AGCAGCCGACAGUACGGGCA

Table 4: Drosophila microRNA and anti-microRNA sequences.

microRNA name	microRNA sequence	Anti-microRNA molecule
microkia name	(5' to 3')	
Dme-miR-263a	GUUAAUGGCACUGGAAGAAUUC	sequence (5' to 3') GAAUUCUUCCAGUGCCAUUAAC
Dme-miR-184	UGGACGGAGAACUGAUAAGGGC	GCCCUUAUCAGUUCUCCGUCCA
Dme-miR-184	UUUUGUGACCGACACUAACGGC	CCCGUUAGUGUCGGUCACAAAA
Dme-miR-275	UCAGGUACCUGAAGUAGCGCGC	
		GCGCGCUACUUCAGGUACCUGA
Dme-miR-92a Dme-miR-219	CAUUGCACUUGUCCCGGCCUAU UGAUUGUCCAAACGCAAUUCUU	AUAGGCCGGGACAAGUGCAAUG
	UAGGAACUUCAUACCGUGCUCU	AAGAAUUGCGUUUGGACAAUCA AGAGCACGGUAUGAAGUUCCUA
Dme-miR-276a		
Dme-miR-277	UAAAUGCACUAUCUGGUACGAC UCGGUGGGACUUUCGUCCGUUU	GUCGUACCAGAUAGUGCAUUUA AAACGGACGAAAGUCCCACCGA
Dme-miR-278		
Dme-miR-133	UUGGUCCCCUUCAACCAGCUGU UGACUAGAUCCACACUCAUUAA	ACAGCUGGUUGAAGGGGACCAA
Dme-miR-279		UUAAUGAGUGUGGAUCUAGUCA
Dme-miR-33	AGGUGCAUUGUAGUCGCAUUGU	ACAAUGCGACUACAAUGCACCU
Dme-miR-280	UGUAUUUACGUUGCAUAUGAAA	UUUCAUAUGCAACGUAAAUACA
Dme-miR-281	UGUCAUGGAAUUGCUCUCUUUG	CAAAGAGAGCAAUUCCAUGACA
Dme-miR-282	AAUCUAGCCUCUACUAGGCUUU	AAAGCCUAGUAGAGCUAGAUU
Dme-miR-283	UAAAUAUCAGCUGGUAAUUCUG	CAGAAUUACCAGCUGAUAUUUA
Dme-miR-284	UGAAGUCAGCAACUUGAUUCCA	UGGAAUCAAGUUGCUGACUUCA
Dme-miR-34	UGGCAGUGUGGUUAGCUGGUUG	CAACCAGCUAACCACACUGCCA
Dme-miR-124	UAAGGCACGCGGUGAAUGCCAA	UUGGCAUUCACCGCGUGCCUUA
Dme-miR-79	UAAAGCUAGAUUACCAAAGCAU	AUGCUUUGGUAAUCUAGCUUUA
Dme-miR-276b	UAGGAACUUAAUACCGUGCUCU	AGAGCACGGUAUUAAGUUCCUA
Dme-miR-210	UUGUGCGUGUGACAGCGGCUAU	AUAGCCGCUGUCACACGCACAA
Dme-miR-285	UAGCACCAUUCGAAAUCAGUGC	GCACUGAUUUCGAAUGGUGCUA
Dme-miR-100	AACCCGUAAAUCCGAACUUGUG	CACAAGUUCGGAUUUACGGGUU
Dme-miR-92b	AAUUGCACUAGUCCCGGCCUGC	GCAGGCCGGGACUAGUGCAAUU
Dme-miR-286	UGACUAGACCGAACACUCGUGC	GCACGAGUGUUCGGUCUAGUCA
Dme-miR-287	UGUGUUGAAAAUCGUUUGCACG	CGUGCAAACGAUUUUCAACACA
Dme-miR-87	UUGAGCAAAUUUCAGGUGUGU	ACACACCUGAAAUUUUGCUCAA
Dme-miR-263b	CUUGGCACUGGGAGAAUUCACA	UGUGAAUUCUCCCAGUGCCAAG
Dme-miR-288	UUUCAUGUCGAUUUCAUUUCAU	AUGAAAUGAAAUCGACAUGAAA
Dme-miR-289	UAAAUAUUUAAGUGGAGCCUGC	GCAGGCUCCACUUAAAUAUUUA
Dme-bantam	UGAGAUCAUUUUGAAAGCUGAU	AUCAGCUUUCAAAAUGAUCUCA
Dme-miR-303	UUUAGGUUUCACAGGAAACUGG	CCAGUUUCCUGUGAAACCUAAA
Dme-miR-31b	UGGCAAGAUGUCGGAAUAGCUG	CAGCUAUUCCGACAUCUUGCCA
Dme-miR-304	UAAUCUCAAUUUGUAAAUGUGA	UCACAUUUACAAAUUGAGAUUA
Dme-miR-305	AUUGUACUUCAUCAGGUGCUCU	AGAGCACCUGAUGAAGUACAAU
Dme-miR-9c	UCUUUGGUAUUCUAGCUGUAGA	UCUACAGCUAGAAUACCAAAGA
Dme-miR-306	UCAGGUACUUAGUGACUCUCAA	UUGAGAGUCACUAAGUACCUGA
Dme-miR-9b	UCUUUGGUGAUUUUAGCUGUAU	AUACAGCUAAAAUCACCAAAGA
Dme-miR-125	UCCCUGAGACCCUAACUUGUGA	UCACAAGUUAGGGUCUCAGGGA
Dme-miR-307	UCACAACCUCCUUGAGUGAGCG	CGCUCACUCAAGGAGGUUGUGA
Dme-miR-308	AAUCACAGGAUUAUACUGUGAG	CUCACAGUAUAAUCCUGUGAUU
dme-miR-31a	UGGCAAGAUGUCGGCAUAGCUG	CAGCUAUGCCGACAUCUUGCCA
dme-miR-309	GCACUGGGUAAAGUUUGUCCUA	UAGGACAAACUUUACCCAGUGC
dme-miR-310	UAUUGCACACUUCCCGGCCUUU	AAAGGCCGGGAAGUGUGCAAUA
dme-miR-311	UAUUGCACAUUCACCGGCCUGA	UCAGGCCGGUGAAUGUGCAAUA
dme-miR-312	UAUUGCACUUGAGACGGCCUGA	UCAGGCCGUCUCAAGUGCAAUA
dme-miR-313	UAUUGCACUUUUCACAGCCCGA	UCGGGCUGUGAAAAGUGCAAUA
dme-miR-314	UAUUCGAGCCAAUAAGUUCGG	CCGAACUUAUUGGCUCGAAUA

microRNA name	microRNA sequence	Anti-microRNA molecule
	(51 to 31)	sequence (5' to 3')
dme-miR-315	UUUUGAUUGUUGCUCAGAAAGC	GCUUUCUGAGCAACAAUCAAAA
dme-miR-316	UGUCUUUUUCCGCUUACUGGCG	CGCCAGUAAGCGGAAAAAGACA
dme-miR-317	UGAACACAGCUGGUGGUAUCCA	UGGAUACCACCAGCUGUGUUCA
dme-miR-318	UCACUGGGCUUUGUUUAUCUCA	UGAGAUAAACAAAGCCCAGUGA
dme-miR-2c	UAUCACAGCCAGCUUUGAUGGG	CCCAUCAAAGCUGGCUGUGAUA
Dme-miR-iab45p	ACGUAUACUGAAUGUAUCCUGA	UCAGGAUACAUUCAGUAUACGU
Dme-miR-iab43p	CGGUAUACCUUCAGUAUACGUA	UACGUAUACUGAAGGUAUACCG

EXAMPLES

Example 1: Materials and Methods

Oligonucleotide synthesis

MiR-21 were synthesized using 5'-silyl, 2'-ACE phosphoramidites (Dharmacon, Lafayette, CO, USA) on 0.2 μ mol synthesis columns using a modified ABI 394 synthesizer (Foster City, CA, USA) (Scaringe, Methods Enzymol. 317, 3-18 (2001) and Scaringe, Methods 23, 206-217 (2001)). The phosphate methyl group was removed by flushing the column with 2 ml of 0.2 M 2-carbamoyl-2-cyanoethylene-1,1-dithiolate trihydrate in DMF/water (98:2 v/v) for 30 min at room temperature. The reagent was removed and the column rinsed with 10 ml water followed by 10 ml acetonitrile. The oligonucleotide was cleaved and eluted from the solid support by flushing with 1.6 ml of 40% aqueous methylamine over 2 min, collected in a screwcap vial and incubated for 10 min at 55 °C. Subsequently, the base-treated oligonucleotide was dried down in an Eppendorf concentrator to remove methylamine and water. The residue was dissolved in sterile 2'-deprotection buffer (400 μ l of 100 mM acetate-TEMED, pH 3.8, for a 0.2 μ mol scale synthesis) and incubated for 30 minutes at 60 °C to remove the 2' ACE group. The oligoribonucleotide was precipitated from the acetate-TEMED solution by adding 24 μ l 5 M NaCl and 1.2 ml of absolute ethanol.

2'-O-Methyl oligoribonucleotides were synthesized using 5'-DMT, 2'-O-methyl phosphoramidites (Proligo, Hamburg, Germany) on 1 μmol synthesis columns loaded with 3'-aminomodifier (TFA) C7 Icaa control pore glass support (Cherngenes, MA, USA). The aminolinker was added in order to also use the oligonucleotides for conjugation to amino group

reactive reagents, such as biotin succinimidyl esters. The synthesis products were deprotected for 16 h at 55 °C in 30% aqueous ammonia and then precipitated by the addition of 12 ml absolute 1-butanol. The full-length product was then gel-purified using a denaturing 20% polyacrylamide gel. 2'-Deoxyoligonucleotides were prepared using 0.2 µmol scale synthesis and standard DNA synthesis reagents (Proligo, Hamburg, Germany).

The sequences of the 2'-O-methyl oligoribonucleotides were 5'-GUCAACAUCAGUCUGAUAAGCUAL (L, 3' aminolinker) for 2'-OMe miR-21, and 5'-AAGGCAAGCUGACCCUGAAGUL for EGFP 2'-OMe antisense, 5'-UGAAGUCCCAGUCGAACGGAAL for EGFP 2'-OMe reverse; the sequence of chimeric 2'-OMe/DNA oligonucleotides was 5'-GTCAACATCAGTCTGATAAGCTAGCGL for 2'-deoxy miR-21 (underlined, 2'-OMe residues), and 5'-AAGGCAAGCTGACCCTGAAGTGCGL for EGFP 2'-deoxy antisense.

The miR-21 cleavage substrate was prepared by PCR-based extension of the partially complementary synthetic DNA oligonucleotides 5'-

GGCATAAAGAATTGAAGAGTTTTCACTGCATACGACGATTCTGTGATTTGTATTC AGCCCATATCGTTTCATAGCTTCTGCCAACCGA. The extended dsDNA was then used as template for a new PCR with primers 5'-

TAATACGACTCACTATAGAACAATTGCTTTTACAG and 5'-

ATTTAGGTGACACTATAGGCATAAAGAATTGAAGA to introduce the T7 and SP6 promoter sequences for in vitro transcription. The PCR product was ligated into pCR2.1-TOPO (Invitrogen). Plasmids isolated from sequence-verified clones were used as templates for PCR to produce sufficient template for run-off in vitro transcription reactions using phage RNA polymerases (Elbashir et al., EMBO 20, 6877-6888 (2001)). ³²P-Cap-labelling was performed as reported (Martinez et al., Cell 110, 563-574 (2002)).

Plasmids

Plasmids pEGFP-S-21 and pEGFP-A-21 were generated by T4 DNA ligation of preannealed oligodeoxynucleotides 5'-GGCCTCAACATCAGTCTGATAAGCTAGGTACCT

and 5'-GGCCAGGTACCTAGCTTATCAGACTGATGTTGA into NotI digested pEGFP-N-1 (Clontech). The plasmid pHcRed-C1 was from Clontech.

HeLa extracts and miR-21 quantification

HeLa cell extracts were prepared as described (Dignam et al., Nucleic Acid Res. 11 1475-1489 (1983)). $5x10^9$ cells from HeLa suspension cultures were collected by centrifugation and washed with PBS (pH7.4). The cell pellet (approx. 15 ml) was re-suspended in two times of its volume with 10mM KCl/1.5 mM MgCl₂/0.5 mM dithiothreitol/10mM HEPES-KOH (pH 7.9) and homogenized by douncing. The nuclei were then removed by centrifugation of the cell lysate at 1000 g for 10 min. The supernatant was spun in an ultracentrifuge for 1 h at 10,5000 g to obtain the cytoplasmic S100 extract. The concentration of KCl of the S100 extract was subsequently raised to 100 mM by the addition of 1 M KCl. The extract was then supplemented with 10% glycerol and frozen in liquid nitrogen.

280 μg of total RNA was isolated from 1 ml of S100 extract using the acidic guanidinium thiocyanate-phenol-chloroform extraction method (Chomczynski et al., Anal. Biochem. *162*, 156-159 (1987)). A calibration curve for miR-21 Northern signals was produced by loading increasing amounts (10 to 30000 pg) of synthetically made miR-21 (Lim et al. et al., Genes & Devel. *17*, 991-1008 (2003)). Northern blot analysis was performed as described using 30 μg of total RNA per well (Lagos-Quintana et al., Science *294*, 853-858 (2001)).

In vitro miRNA cleavage and inhibition assay

2'-O-Methyl oligoribonucleotides or 2'-deoxyoligonucleotides were pre-incubated with HeLa S100 at 30 °C for 20 min prior to the addition of the cap-labeled miR-21 target RNA. The concentration of the reaction components were 5 nM target RNA, 1 mM ATP, 0.2 mM GTP, 10 U/ml RNasin (Promega) and 50% HeLa S100 extract in a final reaction volume of 25 µl. The reaction time was 1.5 h at 30 °C. The reaction was stopped by addition of 200 µl of 300 mM NaCl/25 mM EDTA/20% w/v SDS/200 mM Tris HCl (pH7.5). Subsequently, proteinase K was added to a final concentration of 0.6 mg/ml and the sample was incubated for 15 min at 65 °C. After phenol/chloroform extraction, the RNA was ethanol-precipitated and separated on a 6% denaturing polyacrylamide gel. Radioactivity was detected by phosphorimaging.

Cell culture and transfection

HeLa S3 and HeLa S3/GFP were grown in 5% CO2 at 37 °C in Dulbecco's modified Eagle's medium (DMEM) supplemented with 10% fetal bovine serum (FBS), 100 unit/ml penicillin, and 100 μg/ml streptomycin. One day before transfection, 105 cells were plated in 500 μl DMEM containing 10% FBS per well of a 24-well plate. Plasmid and plasmid/oligonucleotide transfection was carried out with Lipofectamine2000 (Invitrogen). 0.2 μg pEGFP or its derivatives were cotransfected with 0.3 μg pHcRed with or without 10 pmol of 2'-O-methyl oligoribonucleotide or 10 pmol of 2'-deoxyoligonucleotide per well. Fluorescent cell images were recorded on a Zeiss Axiovert 200 inverted fluorescence microscope (Plan-Apochromat 10x/0.45) equipped with Chroma Technology Corp. filter sets 41001 (EGFP) and 41002c (HcRed) and AxioVision 3.1 software.

Example 2: MicroRNA-21 Cleavage of Target RNA

In order to assess the ability of modified oligonucleotides to specifically interfere with miRNA function, we used our previously described mammalian biochemical system developed for assaying RISC activity (Martinez et al., Cell 100, 563-574 (2002)). Zamore and colleagues (Hutvágner et al., Science 297, 2056-2050 (2002)) showed that crude cytoplasmic cell lysates and eIF2C2 immunoprecipitates prepared from these lysates contain let-7 RNPs that specifically cleave let-7-complementary target RNAs. We previously reported that in HeLa cells, numerous miRNAs are expressed including several let-7 miRNA variants (Lagos-Quintana et al., Science 294, 853-858 (2001)).

To assess if other HeLa cell miRNAs are also engaged in RISC like miRNPs we examined the cleavage of a 32P-cap-labelled substrate RNA with a complementary site to the highly expressed miR-21 (Lagos-Quintana et al., Science 294, 853-858 (2001); Mourelatos et al., Genes & Dev. 16, 720-728 (2002)). Sequence-specific target RNA degradation was readily observed and appeared to be approximately 2- to 5-fold more effective than cleavage of a similar let-7 target RNA (Figure 2A, lane 1, and data not shown). We therefore decided to interfere with miR-21 guided target RNA cleavage.

Example 3: Anti MicroRNA-21 2'-O-methyl Oligoribonucleotide Inhibited MicroRNA-21-Induced Cleavage of Target RNA

A 24-nucleotide 2'-O-methyl oligoribonucleotide that contained a 3' C7 aminolinker and was complementary to the longest form of the miR-21 was synthesized. The aminolinker was introduced in order to enable post-synthetic conjugation of non-nucleotidic residues such as biotin.

Increasing concentrations of anti miR-21 2'-O-methyl oligoribonucleotide and a control 2'-O-methyl oligoribonucleotide cognate to an EGFP sequence were added to the S100 extract 20 min prior to the addition of 32P-cap-labelled substrate. We determined the concentration of miR-21 in the S100 extract by quantitative Northern blotting to be 50 pM (Lim et al., Genes & Devel. 17, 991-1008 (2003)).

The control EGFP oligonucleotide did not interfere with miR-21 cleavage even at the highest applied concentration (Figure 2A, lanes 2-3). In contrast, the activity of miR-21 was completely blocked at a concentration of only 3 nM (Figure 2A, lane 5), and a concentration of 0.3 nM showed a substantial 60%-70% reduction of cleavage activity (Figure 2, lane 6). At a concentration of 0.03 nM, the cleavage activity of miR-21 was not affected when compared to the lysate alone (Figure 2, lane 1, 7).

Antisense 2'-deoxyoligonucleotides (approximately 90% DNA molecules) at concentrations identical to those of 2'-O-methyl oligoribonucleotides, we could not detect blockage of miR-21 induced cleavage (Figure 2A, lanes 8-10). The 2'-deoxynucleotides used in this study were protected against 3'-exonucleases by the addition of three 2'-O-methyl ribonucleotide residues.

Example 4: Anti MicroRNA-21 2'-O-methyl Oligoribonucleotide Inhibited MicroRNA-21-Induced Cleavage of Target RNA *In Vitro*

In order to monitor the activity of miR-21 in HeLa cells, we constructed reporter plasmids that express EGFP mRNA that contains in its 3' UTR a 22-nt sequence complementary to miR-21 (pEGFP-S-21) or in sense orientation to miR-21 (p-EGFP-A-21). Endogenous miRNAs have previously been shown to act like siRNAs by cleaving reporter mRNAs carrying

sequences perfectly complementary to miRNA. To monitor transfection efficiency and specific interference with the EGFP indicator plasmids, the far-red fluorescent protein encoding plasmid pHcRed-C1 was cotransfected.

Expression of EGFP was observed in HeLa cells transfected with pEGFP and pEGFP-A-21 (Figure 3, rows 1 and 2), but not from those transfected with pEGFP-S-21 (Figure 3, row 3). However, expression of EGFP from pEGFP-S-21 was restored upon cotransfection with anti miR-21 2'-O-methyl oligoribonucleotide (Figure 3, row 4). Consistent with our above observation, the 2'-deoxy anti miR-21 oligonucleotide showed no effect (Figure 3, row 5). Similarly, cotransfection of the EGFP 2'-O-methyl oligoribonucleotide in sense orientation with respect to the EGFP mRNA (or antisense to EGFP guide siRNA) had no effect (Figure 3,row 6).

We have demonstrated that miRNP complexes can be effectively and sequencespecifically inhibited with 2'-O-methyl oligoribonucleotides antisense to the guide strand positioned in the RNA silencing complex.

What we claim is:

1. An isolated single stranded anti-microRNA molecule comprising a minimum of ten moieties and a maximum of fifty moieties on a molecular backbone, the molecular backbone comprising backbone units, each moiety comprising a base bonded to a backbone unit, each base forming a Watson-Crick base pair with a complementary base wherein:

at least ten contiguous bases have the same sequence as a sequence of bases in any one of the anti-microRNA molecules shown in Tables 1-4, except that up to thirty percent of the bases pairs may be wobble base pairs, and up to 10% of the contiguous bases may be additions, deletions, mismatches, or combinations thereof;

no more than fifty percent of the contiguous moieties contain deoxyribonuleotide backbone units;

the moiety in the molecule at the position corresponding to position 11 of the microRNA is non-complementary; and

the molecule is capable of inhibiting microRNP activity.

- 2. A molecule according to claim 1, wherein up to 5% of the contigous moieties are additions, deletions, mismatches, or combinations thereof.
- 3. A molecule according to claim 1, wherein at least one of the moieties is a deoxyribonucleotide.
- 4. A molecule according to claim 3, wherein the deoxyribonucleotide is a modified deoxyribonucleotide moiety.
- 5. A molecule according to claim 4, wherein the modified deoxyribonucleotide is a phosphorothioate deoxyribonucleotide moiety.
- 6. A molecule according to claim 4, wherein the modified deoxyribonucleotide is N'3-N'5 phosphoroamidate deoxyribonucleotide moiety.

7. A molecule according to claim 1, wherein at least one of the molecules is a ribonucleotide moiety.

- 8. A molecule according to claim 7, wherein at least one of the moi eties is a modified ribonucleotide moiety.
- 9. A molecule according to claim 8, wherein the modified ribonucleotide is substituted at the 2' position.
- 10. A molecule according to claim 9, wherein the substituent at the 2' position is a C_1 to C_4 alkyl group.
- 11. A molecule according to claim 10, wherein the alkyl group is me thyl.
- 12. A molecule according to claim 10, wherein the alkyl group is allyl.
- 13. A molecule according to claim 9, wherein the substituent at the 2 ' position is a C_1 to C_4 alkoxy C_1 to C_4 alkyl group.
- 14. A molecule according to claim 13, wherein the C_1 to C_4 alkoxy C_1 to C_4 alkyl group is methoxyethyl.
- 15. A molecule according to claim 8, wherein the modified ribonucle otide has a methylene bridge between the 2'-oxygen atom and the 4'-carbon atom.
- 16. A molecule according to claim 1, wherein at least one of the moieties is a peptide nucleic acid moiety.
- 17. A molecule according to claim 1, wherein at least one of the moieties is a 2'-fluororibonucleotide moiety.
- 18. A molecule according to claim 1, wherein at least one of the moieties is a morpholino phosphoroamidate nucleotide moiety.
- 19. A molecule according to claim 1, wherein at least one of the moieties is a tricyclo nucleotide moiety.

20. A molecule according to claim 1, wherein at least one of the moieties is a cyclohexene nucleotide moiety.

- 21. A molecule according to claim 1, wherein the molecule comprises at least one modified moiety for increased nuclease resistance.
- 22. A molecule according to claim 21, wherein the nuclease is an exonuclease.
- 23. A molecule according to claim 22, wherein the molecule comprises at least one modified moiety at the 5' end.
- 24. A molecule according to claim 22, wherein the molecule comprises at least two modified moieties at the 5' end.
- 25. A molecule according to claim 22, wherein the molecule comprises at least one modified moiety at the 3' end.
- 26. A molecule according to claim 22, wherein the molecule comprises at least two modified moieties at the 3' end.
- 27. A molecule according to claim 22, wherein the molecule comprises at least one modified moiety at the 5' end and at least one modified moiety at the 3'end.
- 28. A molecule according to claim 22, wherein the molecule comprises at least two modified moieties at the 5' end and at least two modified moieties at the 3'end.
- 29. A molecule according to claim 22, wherein the molecule comprises a nucleotide cap at the 5' end, the 3' end or both.
- 30. A molecule according to claim 22, wherein the molecule comprises an ethylene glycol compound and/or amino linkers at the 5' end, the 3' end, or both.
- 31. A molecule according to claim 1, wherein the nuclease is an endonuclease.
- 32. A molecule according to claim 31, wherein the molecule comprises at least one modified moiety between the 5' and 3' end.

33. A molecule according to claim 31, wherein the molecule comprises an ethylene glycol compound and/or amino linker between the 5' end and 3' end.

- 34. A molecule according to claim 1, wherein all of the moieties are nuclease resistant.
- 35. A method for inhibiting microRNP activity in a cell, the microRNP comprising a microRNA molecule, the microRNA molecule comprising a sequences of bases complementary of the sequence of bases in a single stranded anti-microRNA molecule, the method comprising introducing into the cell the single-stranded anti-microRNA molecule comprising a sequence of a minimum of ten moieties and a maximum of fifty moieties on a molecular backbone, the molecular backbone comprising backbone units, each moiety comprising a base bonded to a backbone unit, each base forming a Watson-Crick base pair with a complementary base, wherein:

at least ten contiguous bases of the anti-microRNA molecule are complementary to the microRNA, except that up to thirty percent of the bases may be substituted by wobble base pairs, and up to ten percent of the at least ten moieties are addition, deletions, mismatches, or combinations thereof;

no more than fifty percent of the contiguous moieties contain deoxyribonuleotide backbone units; and

the moiety in the molecule at the position corresponding to position 11 of the microRNA is non-complementary.

- 36. A method according to claim 35, wherein the anti-microRNA is a human anti-microRNA.
- 37. A method according to claim 35, wherein the anti-microRNA is a mouse anti-microRNA.
- 38. A method according to claim 35, wherein the anti-microRNA is a rat anti-microRNA.
- 39. A method according to claim 35, wherein the ant-microRNA is a drosophila microRNA.
- 40. A method according to claim 35, wherein the anti-microRNA is a C. elegans microRNA.

41. An isolated microRNA molecule comprising a minimum of ten moieties and a maximum of fifty moieties on a molecular backbone, the molecular backbone comprising backbone units, each moiety comprising a base bonded to a backbone unit wherein:

at least ten contiguous bases have the same sequence as a sequence of bases in any one of the microRNA molecules shown in Table 2, except that up to thirty percent of the bases pairs may be wobble base pairs, and up to 10% of the contiguous bases are additions, deletions, mismatches, or combinations thereof; and

no more than fifty percent of the contiguous moieties contain deoxyribonuleotide backbone units.

- 42. A molecule according to claim 41 having the sequence shown in Table 2.
- 43. A molecule according to claim 41, wherein the molecule is modified for increased nuclease resistance.
- 44. A molecule according to claim 41, wherein the moiety at position 11 is an addition, deletion or substitution.
- 45. An isolated microRNA molecule comprising a minimum of ten moieties and a maximum of fifty moieties on a molecular backbone, the molecular backbone comprising backbone units, each moiety comprising a base bonded to a backbone unit wherein:

at least ten contiguous bases have any one of the microRNA sequences shown in Tables 1, 3 and 4, except that up to thirty percent of the bases pairs may be wobble base pairs, and up to 10% of the contiguous bases are additions, deletions, mismatches, or combinations thereof;

no more than fifty percent of the contiguous moieties contain deoxyribonuleotide backbone units; and

is modified for increased nuclease resistance.

46. A molecule according to claim 45, wherein the molecule is modified for increased nuclease resistance.

47. A molecule according to claim 45, wherein the moiety at position 11 is an addition, deletion, or substitution.

48. An isolated single stranded anti-microRNA molecule comprising a minimum of ten moieties and a maximum of fifty moieties on a molecular backbone, the molecular backbone comprising backbone units, each moiety comprising a base bonded to a backbone unit, each base forming a Watson-Crick base pair with a complementary base wherein:

at least ten contiguous bases have the same sequence as a sequence of bases in any one of the anti-microRNA molecules shown in Tables 1-4, except that up to thirty percent of the bases pairs may be wobble base pairs, and up to 10% of the contiguous bases may be additions, deletions, mismatches, or combinations thereof;

no more than fifty percent of the contiguous moieties contain deoxyribonuleotide backbone units; and

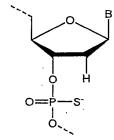
the molecule is capable of inhibiting microRNP activity.

49. A method for inhibiting microRNP activity in a cell, the microRNP comprising a microRNA molecule, the microRNA molecule comprising a sequences of bases complementary of the sequence of bases in a single stranded anti-microRNA molecule, the method comprising introducing into the cell the single-stranded anti-microRNA molecule comprising a sequence of a minimum of ten moieties and a maximum of fifty moieties on a molecular backbone, the molecular backbone comprising backbone units, each moiety comprising a base bonded to a backbone unit, each base forming a Watson-Crick base pair with a complementary base, wherein:

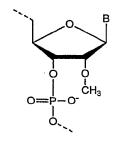
at least ten contiguous bases of the anti-microRNA molecule are complementary to the microRNA, except that up to thirty percent of the bases may be substituted by wobble base pairs, and up to ten percent of the at least ten moieties may be additions, deletions, mismatches, or combinations thereof; and

no more than fifty percent of the contiguous moieties contain deoxyribonuleotide backbone units.

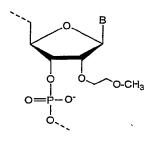
Figure 1



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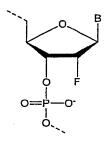
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2'-O-methoxy-ethyl RNA unit (MOE) Structure 4

Peptide nucleic acid unit (PNA) Structure 6

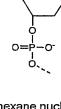
N3'-P5' Phosphoroamidate DINA unit (NP) Structure 2



2'-fluoro-ribo nucleic acid unit (FANA) Structure 7

Locked nucleic acid unit (LNA) Structure 5

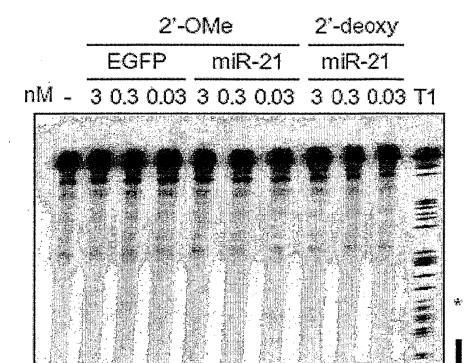
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Structure 8



Cyclohexane nucleic acid unit (CeNA) Structure 10

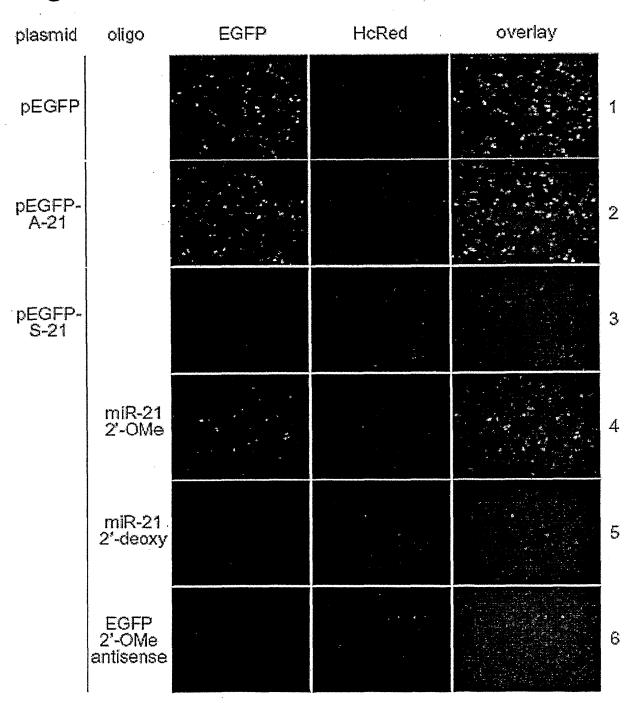
Tricyclonucleic acid umit Structure 9

Figure 2



10

Figure 3



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1119-10CON-PCT.ST25

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1119-10CON-PCT.ST25

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1119-10CON-PCT.ST25

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